

NUCLEAR SCIENCE ABSTRACTS

Vol. 8, No. 1, January 15, 1954

TABLE OF CONTENTS

Category	Abstract	Page	Category	Abstract	Page
CALENDAR OF MEETINGS		iv	MINERALOGY, METALLURGY, AND CERAMICS		
GENERAL	1	1	Geology and Mineralogy	213	
Research Programs	2		Metals and Metallurgy	224	
BIOLOGY AND MEDICINE	3	1	PHYSICS	274	31
Radiation Effects	27		Aerosols	293	
Radiation Hazards and Protection	54		Cosmic Radiation	294	
Radiotherapy	63		Crystallography and Crystal Structure	298	
Toxicology Studies	64		Electrical Discharge	302	
Tracer Applications	66		Electrons	306	
CHEMISTRY	86	10	Gases	309	
Aerosols	126		Instruments	312	
Analytical Procedures	127		Isotopes	323	
Crystallography and Crystal Structure	142		Mass Spectrography	325	
Deuterium and Deuterium Compounds	143		Mathematics	331	
Fluorine and Fluorine Compounds	146		Measuring Instruments and Techniques	334	
Graphite	161		Mesons	365	
Laboratories and Equipment	164		Microwaves	370	
Radiation Chemistry	166		Molecular Properties	372	
Radiation Effects	169		Nuclear Physics	373	
Separation Procedures	172		Nuclear Properties	377	
Spectroscopy	179		Nuclear Reactors	386	
Syntheses	182		Nuclear Transformation	389	
Tracer Applications	187		Particle Accelerators	390	
Transuranic Elements and Compounds	188		Radiation Absorption and Scattering	393	
Tritium and Tritium Compounds	189		Radiation Effects	401	
Uranium and Uranium Compounds	190		Radioactivity	405	
ENGINEERING	194	22	Rare Earths and Rare-earth Compounds	412	
Heat Transfer and Fluid Flow	197		Shielding	413	
Materials Testing	203		Spectroscopy	414	
Radiography	205		Theoretical Physics	423	
MINERALOGY, METALLURGY, AND CERAMICS	207	23	Uranium and Uranium Compounds	425	
Ceramics and Refractories	207		AUTHOR INDEX		A
Corrosion	208		NUMERICAL INDEX OF REPORTS		H

CALENDAR OF MEETINGS

Suggestions for additions to this list will be welcomed and should be sent with all pertinent information to the Cataloging Branch, Technical Information Service, U. S. Atomic Energy Commission, P. O. Box 62, Oak Ridge, Tennessee.

March 15-19, 1954

ELEVATED TEMPERATURE CORROSION SYMPOSIUM, Municipal Auditorium, Kansas City, Mo. Sponsored by: National Association of Corrosion Engineers-10th Annual Conference

Person to Contact: Glenn A. Fitzlen
Ass't. Technical Director
Haynes Stellite Co.
Kokomo, Ind.

June 20-25, 1954

NUCLEAR ENGINEERING CONFERENCE, University of Michigan, Ann Arbor, Michigan, Sponsored by: American Institute of Chemical Engineers.

Inquiries should be addressed to: Professor Donald Katz, University of Michigan, Department of Engineering, Ann Arbor, Michigan.

July 19-24, 1954

SECOND RADIOISOTOPE CONFERENCE (a conference on the peaceful uses of atomic energy), Oxford, England,

Arranged by: The Atomic Energy Research Establishment, Harwell.

Inquiries should be addressed to: The Conference Secretary, Atomic Energy Research Establishment, Harwell, Didcot, Berks, England.

GENERAL

1
Technical Information Service, AEC
UNCLASSIFIED BIBLIOGRAPHIES OF INTEREST TO THE
ATOMIC ENERGY PROGRAM. Paul E. Postell and Hugh E
Voress, comps. Oct. 2, 1953. 60p. (TID-3043)

This compilation contains annotated references to
bibliographies prepared by the AEC project and to some from
commercial, scientific, and other government organizations.
The bibliographies are arranged by subject, and multiple
listings are made for those which cover more than one
subject. A table of contents lists the subjects covered. An
author index is included. (auth)

RESEARCH PROGRAMS

2
Atomic Energy Commission
THE RESEARCH PROGRAM OF THE ATOMIC ENERGY
COMMISSION BIOLOGY BRANCH. N. Edward Tolbert.
p.31-40 of CONFERENCE ON THE USE OF ISOTOPES IN
PLANT AND ANIMAL RESEARCH. Apr. 1953. 10p.
(TID-5098(p.31-40))

Objectives of the program of biology research supported
by the AEC and administered through the Division of Biology
and Medicine are outlined. The role of the National Labora-
tories and of university projects in carrying out AEC-
sponsored basic research and investigations concerning
programmatic problems is discussed. It is pointed out that
AEC biological research extends over basic biochemistry and
metabolism, genetics, animal physiology and nutrition,
radiation effects on plants and animals, soils and plant
physiology, and aquatic ecological surveys and can be
directed toward constructive uses which will make enormous
contributions to the well-being of man and to his understand-
ing of nature. (C.H.)

BIOLOGY AND MEDICINE

3
Cancer Research Inst., New England Deaconess Hospital,
Boston
MEASUREMENT OF ERYTHROCYTIC DIAMETERS WITH
PHASE MICROSCOPY. Edna H. Tompkins. [1953?] 8p.
(AECU-2717)

The diameters of the erythrocytes of three normal
females were measured by means of phase microscopy.
Mean diameters, based on 20 measurements, ranged from
8.3 μ to 8.9 μ . (C.H.)

4
School of Aviation Medicine
THE EFFECT OF STRESS ON THE METABOLISM OF
ASCORBIC ACID. PART II. INCREASED EXCRETION OF

DEHYDROASCORBIC AND DIKETOGULONIC ACIDS BY
RATS AFTER X-RAY IRRADIATION. Mary Mills Monier
and Roslyn J. Weiss. PART III. CHANGES IN TISSUE
LEVELS OF ASCORBIC, DEHYDROASCORBIC, AND
DIKETOGULONIC ACIDS IN THE RAT EXPOSED TO COLD.
Mary Mills Monier, Seymour Byer, and Roslyn J. Weiss.
PART IV. THE INCREASED EXCRETION OF DEHYDRO-
ASCORBIC AND DIKETOGULONIC ACIDS IN THE URINE
OF RATS AFTER SEVERE BURNS. Mary Mills Monier and
Roslyn J. Weiss. School of Aviation Medicine and George
Washington Univ. School of Medicine. Sept. 1953. 12p.
(NP-4911; Reports 2, 3, and 4)

Adult albino rats were burned by immersion in water
at 60°C for 15 sec. Urinary excretion of dehydroascorbic
(DHA) and diketogulonic (DKA) acids increased greatly over
control values established before burning. Adult albino
rats were exposed to environmental temperature of 21°C
for controls and 0°C for experimentals for 72 hr prior to
sacrifice. The adrenal and kidney tissues of the experi-
mental rats showed no increase levels of ascorbic acid
(AsA), DHA, and DKA in comparison with controls. The
liver tissue of the experimental animals had significantly
decreased levels of AsA and increased levels of DHA.
Adult albino rats were exposed to 800 r single-dose total-
body x irradiation. Urinary excretion of DHA increased
150% after irradiation, and DKA excretion increased 230%.
The increase in excretion of oxidized AsA in the urine may
be a general response to stress. (auth)

5
Atomic Energy Project, Univ. of Rochester
FURTHER STUDIES ON A PROCEDURE FOR DETER-
MINING PHAGOCYTTIC ACTIVITY OF LEUKOCYTES IN
WHOLE BLOOD BY INCUBATION WITH SACCHARATED
IRON. M. Ingram, A. Struthers, D. Piatt, J. Welton, and
G. Yettewich. Sept. 8, 1953. 13p. Contract W-7401-eng-
49. (UR-277)

The uptake of saccharated Fe by blood phagocytes has
been found to be first order with respect to leukocytes and
second order with respect to Fe concentration under con-
ditions of these experiments. Acetate ion in amounts
equivalent to 0.2 g % appears to have an inhibitory effect on
the phagocytic activity of dog leukocytes, but not on the
activity of human leukocytes. The rate of phagocytosis is
not appreciably affected by temperature variations over the
range 34.5 to 39.0°C, but increases somewhat at the higher
temperature. (auth)

6
Naval Radiological Defense Lab.
CHANGES IN RED CELL VOLUME AND OSMOTIC
FRAGILITY OF ERYTHROCYTES IN THE RAT FOLLOW-
ING ACUTE BLOOD LOSS. W. M. Davis, J. Bigelow, and
E. L. Alpen. Aug. 14, 1953. 24p. (USNRDL-409)

Changes in circulating red cell volume, reticulocyte
level, and osmotic fragility following acute blood loss by
rats are reported. Significant decreases in the osmotic
fragility of the red blood cells occurred coincident with the
production of a new red blood cell population. The observed
increase in osmotic resistance appears to be related not
only to the increased numbers of reticulocytes but also to
the large number of new erythrocytes present. It is apparent

that this new red cell population, as measured or estimated, is greatly in excess of the reticulocyte level. These studies also demonstrate the sustained and rapid regeneration rate of red blood cells in the young rat subjected to acute blood loss. (auth)

7

NEW DATA ON THE CONNECTIVE TISSUE PROTEINS. V. N. Orekhovich. Translated from Ukrain. Biokhim. Zhur. 22, 455-61(1950). 7p. (AERE-Trans-11/3/5/348)

8

STUDY OF THE FIXATION OF OXYGEN BY A SOLUTION OF HEMOGLOBIN [Etude sur la fixation de l'oxygene par une solution d'hémoglobine] Gilbert Manual and Paul Lambassy. Translated by Inez O'Brien from Helv. Physiol. et Pharmacol. Acta 3, 269-89(1945). 31p. (UCRL-Trans-25)

9

ISOLATION OF CRYSTALLINE PROTEINS FROM THE SKIN OF MAMMALS, BIRDS, REPTILES, AMPHIBIANS AND FISHES. N. E. Plotnikova. Translated from Doklady Akad. Nauk S.S.S.R. 58, 1715-8(1947). 5p. (AERE-Trans-11/3/5/341)

10

THE CONDITIONS OF REVERSIBLE TRANSFORMATIONS OF CHLOROPHYLL TAKING PLACE UNDER THE INFLUENCE OF LIGHT. A. A. Krasnovskii [Krasnovsky], G. P. Breen, and K. K. Voynovskaya. Translated from Doklady Akad. Nauk S.S.S.R. 69, 393-6(1949). 10p. (UCRL-Trans-49)

An investigation was made of the conditions of reversible photoreduction of chlorophylls by various compounds and in different mediums. Data are tabulated on straight photochemical reactions and their reversibility in the dark. (C.H.)

11

INVESTIGATION OF THE CONDENSATION OF DI-OXYACETONE, GLYCOLALDEHYDE AND DIOXYACETONE PHOSPHATE IN THE GREEN LEAF OF PLANT. A. M. Kuzin and N. G. Doman. Translated from Biokhimiya 14, 499-502(1949). 11p. (UCRL-Trans-59)

12

INFLUENCE OF THE DEGREE OF AERATION UPON AUTOTROPHIC AND HETEROTROPHIC NUTRITION OF CHLORELLA. I. L. Rabotnova and I. V. Konova. Translated from Mikrobiologiya 19, 24-31(1950). 18p. (UCRL-Trans-75)

13

ON THE PARTICIPATION OF GLYOXILIC ACID IN THE ASSIMILATION OF NITRATE NITROGEN BY GREEN LEAVES. P. A. Kolesnikov. Translated from Doklady Akad. Nauk S.S.S.R. 71, 911-14(1950). 9p. (UCRL-Trans-76; AEC-tr-1052)

14

DYNAMICS OF AUXIN CONTENT IN LEAVES AND FLOWERS OF RED CLOVER. A. M. Alekheev [Alexeev] and A. V. Startseva. Translated from Doklady Akad. Nauk S.S.S.R. 71, 937-40(1950). 9p. (UCRL-Trans-77)

15

THE INFLUENCE OF SOME FERMENTATIVE POISONS ON THE PHOTOCHEMICAL ACTIVITY OF ISOLATED CHLOROPLASTS. T. F. Andreeva and L. E. Zubkovich. Translated from Doklady Akad. Nauk S.S.S.R. 70, 525-8(1950). 10p. (UCRL-Trans-78; AEC-tr-1054)

16

THE PROBLEM OF THE ROLE OF CAROTENOIDS IN PHOTOSYNTHESIS. D. I. Sapozhnikov [Sapojnikov] and U. B. Lopatkin. [Translated by] V. L. Komarov from

Doklady Akad. Nauk S.S.S.R. 72, 413-5(1950). 6p. (UCRL-Trans-82)

Changes in carotenoids produced during the process of photosynthesis, and the role of reactions in the dark during this change, were investigated in leaves of a number of different plants under 2% CO₂ and illuminated with a 300-w lamp at a distance of 25 cm from the leaf. From results of the study, it was concluded that under conditions favorable for photosynthesis the ratio of carotene to xanthophyll changes. The inhibition of the reactions of photosynthesis in the dark leads to the lowering of this ratio. In all cases, the increase in the amount of carotene was found to correlate with the decrease in the amount of xanthophyll. (C.H.)

17

AN INVESTIGATION OF PHOTOSYNTHESIS BY THE METHOD OF IONOPHORESIS. A. M. Kuzin and N. G. Doman. Translated from Doklady Akad. Nauk S.S.S.R. 72, 77-80(1950). 6p. (UCRL-Trans-83; AEC-tr-1058)

18

PEROXIDASE IN RUBBER PLANTS. N. G. Doman. Translated from Doklady Akad. Nauk S.S.S.R. 71, 1081-4(1950). 8p. (UCRL-Trans-84)

19

OXIDATIVE ENZYMES IN BARLEY LEAVES. P. A. Kolesnikov. Translated from Doklady Akad. Nauk S.S.S.R. 71, 1085-8(1950). 9p. (UCRL-Trans-86)

20

THE THEORETICAL MEANING OF THE V. S. BUTKEVICH INVESTIGATIONS ON THE STUDY OF PROTEIN TRANSFORMATIONS IN PLANT ORGANISM AND THE CHEMISTRY OF THE FORMATION OF ORGANIC ACIDS IN THEM. M. V. Fedorov. Translated from Mikrobiologiya 19, Ed. 4, 369-83(1950). 40p. (UCRL-Trans-88)

21

CONCERNING THE NATURE OF THE REACTION OF CHLOROPHYLL WITH INORGANIC IONS. M. S. Ashkinazi, T. S. Glikman, and B. [Ya.] Dain [Dahn]. [Translated by] L. V. Pisarzhevskii [Pisarjevsky] from Doklady Akad. Nauk S.S.S.R. 73, 743-6(1950). 8p. (UCRL-Trans-90)

22

REACTIONS OF PHOTOREDUCED FORM OF CHLOROPHYLL. A. A. Krasnovskii and G. P. Brin. [Translated by] A. N. Bahk from Doklady Akad. Nauk S.S.S.R. 73, 1239-42(1950). 10p. (UCRL-Trans-91)

23

A STUDY OF THE PRODUCTS OF REDUCTION OF CHLOROPHYLL, ITS DERIVATIVES AND ANALOGUES BY THE REACTION OF TIMIRYAZEV. L. M. Kosobutzkaya and A. A. Krasnovskii. [Translated by] A. N. Timiryazev from Doklady Akad. Nauk S.S.S.R. 74, 103-6(1950). 11p. (UCRL-Trans-92)

24

THE IMMEDIATE PRECURSORS OF SUCROSE IN PLANTS. A. L. Kursanov and O. A. Pavlinova. Translated by B. E. Cushman from Biokhimiya 15, 52-7(1950). 12p. (UCRL-Trans-93; AEC-tr-1023)

25

CRYSTALLIZATION AND SOLUBILITY OF MIOGLOBIN FROM VARIOUS SPECIES. A. Rossi and C. Aragana. Translated by Bonnie E. Cushman from Boll. soc. ital. biol. sper. 17, 206(1942). 4p. (UCRL-Trans-95; AEC-tr-1025)

26

THE PHOTOCHEMICAL PROPERTIES OF PROTOCHLOROPHYLL. A. A. Krasnovskii and K. K. Voynovskaya. [Translated by] H. H. Bank from Doklady Akad. Nauk S.S.S.R. 66, 663-8(1949). 10p. (UCRL-Trans-98)

RADIATION EFFECTS

27

Biological Research Lab., Southern Ill. Univ.

A COMPARATIVE STUDY OF THE RETARDATION OF BUDDING AND CELLULAR INACTIVATION BY ULTRAVIOLET RADIATION IN POLYPLOID SACCHAROMYCES WITH SPECIAL REFERENCE TO PHOTOREACTIVATION. Alvin Sarachek. [1953] 15p. (AECU-2703)

Data are tabulated on the inactivation and growth inhibition of haploid, diploid, triploid, and tetraploid *Saccharomyces* by ultraviolet light and their reactivation by exposure to visible light. Findings are discussed. (C.H.)

28

Ohio Agricultural Experiment Station

THE PHYSIOLOGY AND GENETICS OF PLANT PATHOGENIC MICROORGANISMS WHEN GROWN IN THE PRESENCE OF VARIOUS RADIOISOTOPES. T. Kommedahl, R. S. Davidson, Nancy J. Hockman, S. B. Hughes, and C. Kuehner. [June 1953] 16p. (AECU-2705)

Data are summarized from studies of fungi spore germination when grown on media containing P^{32} , variants found after exposure to P^{32} in growth media, comparative effects on growth produced by media containing Cs^{134} , P^{32} , Sc^{46} , Co^{60} , or Tl^{204} , the biochemical effects of radiation on fungi, and the effects of radiation on the pathogenicity of fungi. (C.H.)

29

Fission Products Lab., Engineering Research Inst., Univ. of Mich.

[UTILIZATION OF FISSION PRODUCTS.] GAMMA-RAY STERILIZATION OF FOOD PACKAGING MATERIALS. L. L. Kempe, J. T. Graikoski, and L. E. Brownell. [1953] 11p. (AECU-2710)

Data are reported from representative experiments on the sterilization of various food-packaging materials by exposure to γ radiation from a Co^{60} source. No damage was observed in any of the samples of plastic, cloth, or paper irradiated. Results indicate that heat- and moisture-sensitive materials can be sterilized in quantity by γ irradiation without significant damage to the materials. Plastic centrifuge tubes were also successfully sterilized by exposure to γ radiation. (C.H.)

30

Fission Products Lab., Engineering Research Inst., Univ. of Mich.

[UTILIZATION OF FISSION PRODUCTS] THE EFFECT OF GAMMA RADIATION ON SOME PHARMACEUTICAL PRODUCTS. J. Controulis, C. A. Lawrence, and L. E. Brownell, Parke, Davis and Co.; Phoenix Project, Univ. of Mich. and Fission Products Lab., Engineering Research Inst., Univ. of Mich. [1953] 13p. (AECU-2711)

Results of preliminary studies of the effects of γ radiation on some pharmaceutical products are presented in tabular form. Complete sterility was obtained in samples contaminated with *B. subtilis* at the end of 24-hr exposure to dosages of 2.04 million rep as measured in air. Results are reported of assays of the biological activity of Ca gluconate solution, ascorbic acid, pituitary gland fraction, estrone, and diphtheria-tetanus-pertussis antitoxin-antisera samples after irradiation times of 0, 1, and 24 hr. Data are tabulated on the effects of γ radiation on the potency of penicillin, streptomycin, aureomycin, chloromycetin, and terramycin as measured 3, 6, and 90 days following irradiation. (C.H.)

31

Chicago Univ.

UTILIZATION OF GROSS FISSION PRODUCTS. PROGRESS REPORTS [OF UNIVERSITY OF CHICAGO, FOOD RESEARCH INSTITUTE, AND AMERICAN MEAT INSTITUTE FOUNDA-

TION] FOR PERIOD ENDING MARCH 31, 1953. Johan Baarli and Lester S. Skaggs, Univ. of Chicago; R. O. Wagenaar, H. Sugiyama and M. J. Surgalla, Food Research Inst.; and C. F. Niven, Jr., D. M. Doty, and B. S. Schweigert, American Meat Inst. Foundation. 59p. (AECU-2718)

A refrigerated Co^{60} γ source, designed for use in studies of the effects of radiation on foods and microorganisms associated with food spoilage, is described. Studies on which preliminary data are presented include the effects of radiation on protein and non-protein N components, proteolytic enzyme systems, heme pigments, and fats in meat, the effect of radiation on the stability of *Staphylococcus enterotoxin* and *Clostridium botulinum*, toxin, and the radio-sensitivity of bacterial spores, and of microorganisms associated with food and food spoilage and food poisoning. Preliminary observations on the appearance and texture of irradiated foods are included. (C.H.)

32

Brookhaven National Lab.

FREQUENCY OF CHROMOSOME ABERRATIONS PRODUCED BY FRACTIONAL DOSES OF X-RAYS IN TRADESCANTIA. Dale Steffensen and T. J. Arnason. [1953?] 17p. (BNL-1524)

When *Tradescantia* microspores were irradiated with 360 r of x rays, the frequency of centric reunions was consistently higher with a single continuous dose than with two 180-r doses separated by 4, 8, 12 and 24 hr. In the fractional dose series there was no significant difference in reunion frequency with increasing time intervals between fractions. This fractional series was not significantly different from the base line. The frequency of one-hit chromosome breaks appeared to be independent of dosage fractionation. (auth)

33

School of Aviation Medicine

THE BIOLOGICAL AND MEDICAL ASPECTS OF IONIZING RADIATION. EARLY EFFECTS OF HIGH INTENSITY X-RADIATION ON SKELETAL MUSCLE. Herbert B. Gerstner, Robert B. Lewis, and Everett O. Richey. May 1953. 13p. (NP-4793; Report 5)

Comparative studies of x radiation effects on both isolated cold-blooded (frog) and intact warm-blooded (rabbit) muscles were performed. Frog muscles irradiated with doses above 50 kr showed early fatigue, contracture, prolongation of relaxation time, decreased contraction amplitude for heavy loads, and histologic changes noticeable 8 hr after exposure. Rabbit muscles exposed to 72 kr exhibited a gradually progressing impairment of function. Complete abolishment of function was reached within 24 hr following irradiation and was accompanied by severe histologic alterations. (auth)

34

Air Force Radiation Lab., Univ. of Chicago

QUARTERLY PROGRESS REPORT NO. 8. July 15, 1953. 113p. (NP-4846)

Separate abstracts have been prepared on two sections of this report. (For preceding period see NP-4602.) (C.H.)

35

Air Force Radiation Lab., Univ. of Chicago

[PHYSIOLOGICAL EFFECTS OF RADIATION.] p.1-66 of QUARTERLY PROGRESS REPORT NO. 8. July 15, 1953. 66p. (NP-4846(p.1-66))

It was demonstrated in irradiated rats that both adenosine triphosphatase and 5-nucleotidase activity of spleen and thymus gland may be used as methods of screening chemical agents for prophylactic and therapeutic action against x-irradiation injury. Data on effects of p-aminopropiophenone on response of these enzyme systems to x irradiation are included. The effect of x irradiation was determined on the

cholinesterase activity of ileum, spleen, liver, serum, brain, heart, submaxillary gland, and skeletal muscles of rats. The 30-day mortality of irradiated control rats and those anesthetized 2 hr after irradiation did not differ significantly, and no effects attributable to whole-body x irradiation were observed on the response of rats to standard doses of morphine sulfate or methadone hydrochloride. Hemin and maleic hydrazide were found to be without effect on the lethality of whole-body x irradiated mice. (C.H.)

36
Air Force Radiation Lab., Univ. of Chicago
[RADIATION EFFECTS.] p.67-109 of QUARTERLY
PROGRESS REPORT NO. 8. July 15, 1953. 43p. (NP-4846(p.67-109))

No differences were apparent between the amino acid-excretion patterns of radiosensitive and radioresistant rats. A decrease in liver catalase activity was demonstrated in rats and guinea pigs following exposure to doses of x radiation slightly above the LD₅₀. Experiments showed that the mechanism of azide protection against radiation lethality is not by the presence of liver catalase. Data are tabulated on the weights and catalase content of rat and guinea pig tissues. A species specificity was demonstrated for injected catalase. No prophylactic effect against radiation injury was afforded to mice by allyl thiourea. X-ray survival curves for three species of amoebae are presented and discussed. No additive protection was afforded mice by dietary Co chloride or by injected p-aminopropiophenone prior to irradiation. Thirteen compounds are tested in mice for possible prophylactic or therapeutic effects against radiation injury. Survival times are tabulated for irradiated mice injected with each compound. (C.H.)

37
School of Aviation Medicine
BIOLOGICAL AND MEDICAL ASPECTS OF IONIZING
RADIATION. THE EFFECT OF LOCAL BRAIN X-
IRRADIATION ON THE PINNA REFLEX OF GUINEA PIGS.
Herbert B. Gerstner, Eugene B. Konecni, and William F.
Taylor. Sept. 1953. 15p. (NP-4856; Report 8)

The heads of 20 guinea pigs were exposed to 8,000 r of x radiation. The threshold of the pinna reflex was determined several times prior to and at various time intervals after irradiation with pure tones of a frequency range between 800 and 6400 cps. In the majority of the animals x radiation caused complete abolishment of the reflex within 24 hr. A statistically significant rise of the threshold became evident at 3 hr following exposure. (auth)

38
School of Aviation Medicine
NUCLEIC ACID METABOLISM OF THE BONE MARROW
AND SPLEEN IN THE RAT. THE COMBINED EFFECTS
OF X-RAY AND HYPOXIA. W. A. Rambach, H. L. Alt,
and J. A. D. Cooper. School of Aviation Medicine and
Northwestern Univ. Medical School. Aug. 1953. 11p.
(NP-4879; Report 2)

Hypoxia at a simulated altitude of 25,000 ft administered during irradiation reduces the injury to the rat bone marrow and spleen. The protective effect is reflected by the greater DNAP concentration and cellularity, the more rapid DNA synthesis as measured by the rate of incorporation of P³² into DNAP, and by differences in the bone marrow differential count. The degree of leukopenia, weight loss, and decrease in spleen size was less pronounced in the irradiated hypoxic animals. Thirty hr of intermittent hypoxia preceding irradiation in a low atmospheric pressure does not give added protection to the bone marrow and spleen. (auth)

39

School of Aviation Medicine
NUCLEIC ACID METABOLISM OF THE BONE MARROW
AND SPLEEN IN THE RAT. THE EFFECT OF X-RAY AND
THE EFFECT OF HYPOXIA. W. A. Rambach, J. A. D.
Cooper, and H. L. Alt. School of Aviation Medicine and
Northwestern Univ. Medical School. June 1953. 11p.
(NP-4881; Report 1)

Biochemical studies are presented on the nucleic acid metabolism of the bone marrow and spleen of rats after 800 r of total-body irradiation and after 30 hr of intermittent hypoxia. A significant decrease in the incorporation of P³² into DNAP and RNAP is noted following irradiation. A significant increase in this measurement is seen following hypoxia. These biochemical changes are correlated with the morphologic variation seen in cellularity and cell types within the organs. The significance of these observations is discussed. (auth)

40

School of Aviation Medicine
BIOLOGICAL AND MEDICAL ASPECTS OF IONIZING
RADIATION. CHANGES IN STRIATED MUSCLE FOLLOW-
ING SINGLE INTENSE DOSES OF X-RAYS. REPORT NO.
6. R. B. Lewis. Sept. 1953. 9p. (NP-4921; Report No. 6)

Destructive lesions of scattered muscle fibers in rabbit legs were observed as early as 3 hr after a single intense dose of x radiation of 72,000 r. As the time after irradiation increased, the damage became more severe, and after 1 week most of the leg tissues were necrotic with no evidence of fibroblastic proliferation to replace the gangrenous muscle. Lesser doses of 36,000 r, 24,000 r, and 12,000 r showed coagulation necrosis of smaller muscle areas and atrophy of muscle fibers in nonnecrotic areas. The severity of the changes progressed as the time following radiation increased. No abnormalities, except possibly slight atrophy of muscle, could be observed after administration of 6,000 r. (auth)

41

[Nebraska Agricultural Experiment Station]
GENETIC EFFECTS OF THERMAL NEUTRON IRRADIATION
IN PLANTS. E. F. Frolik. p.81-7 of CONFERENCE
ON THE USE OF ISOTOPES IN PLANT AND ANIMAL RE-
SEARCH. Apr. 1953. 7p. (TID-5098(p.81-7))

Studies are reported on the effects of thermal neutron irradiation on maize pollen and maize and barley seeds. Data are presented on the effects of irradiation of F₁ maize pollen on F₁ plants, seedling development following irradiation of maize and barley seed, and chromosomal aberrations produced by thermal neutrons. A comparison is made between biological effects produced by thermal neutrons and by x radiation. (C.H.)

42

Argonne National Lab.
EFFECT OF RADIATIONS ON THE GROWTH AND DE-
VELOPMENT OF PLANTS. Norbert J. Scully. p.242-7 of
CONFERENCE ON THE USE OF ISOTOPES IN PLANT AND
ANIMAL RESEARCH. Apr. 1953. 6p. (TID-5098(p.242-7))

The effects of radiation upon plant growth and development are reviewed. Chromosomal aberrations, arrest of cell division, and the radiosensitivity of seeds are discussed. Cytological, growth, and development responses of plants subject to external radiation in the form of x rays and slow neutrons, and of individual plants subjected to internal radiation arising from C¹⁴-labeled natural organic constituents of the plant are discussed. (C.H.)

43

Radiation Lab., Univ. of Calif., Berkeley
MEDICAL AND HEALTH PHYSICS QUARTERLY REPORT,

JANUARY, FEBRUARY, AND MARCH 1953. June 11, 1953. 120p. (UCRL-2243)

Separate abstracts have been prepared on two sections of this report. (For preceding period see UCRL-2111.)

44
Radiation Lab., Univ. of Calif., Berkeley
THE METABOLIC PROPERTIES OF VARIOUS MATERIALS. p.3-59 of MEDICAL AND HEALTH PHYSICS QUARTERLY REPORT, JANUARY, FEBRUARY, AND MARCH 1953. June 11, 1953. 57p. (UCRL-2243(p.3-59))

Preliminary data are tabulated from a study of the relative biological effectiveness of β particles from radiopotassium and α particles from At^{211} . In this study the distribution of tracer amounts of Na^{22} and changes in the blood picture were employed as criteria of radiation damage in four experiments employing rats, and weight changes and alterations in total differential leukocyte counts were employed as criteria of radiation damage in one experiment employing monkeys. Studies of thyroid function, as measured by I^{131} uptake, and the metabolism of F, as measured by F^{18} distribution, in rats chronically intoxicated with fluoride were continued. Data are tabulated. Photographs are included of radioautographs of bones from rats given F^{18} with and without previous dietary fluoride. Additional data are presented from a histological study of a monkey which was sacrificed two years after receiving At^{211} . Morphologic alterations are summarized and illustrated photographically. (C.H.)

45
Radiation Lab., Univ. of Calif., Berkeley
RADIATION CHEMISTRY AND BIOLOGICAL STUDIES OF RADIATION EFFECTS. p.60-113 of MEDICAL AND HEALTH PHYSICS QUARTERLY REPORT, JANUARY, FEBRUARY, AND MARCH 1953. June 11, 1953. 54p. (UCRL-2243(p.60-113))

Results of kinetic studies of radioinduced reactions in aqueous solutions of acetic acid exposed to high-energy He ions are reported. Preliminary results are reported of chromatographic determination of nonvolatile acid products formed. The preparation of target solutions of glycine for a proposed study of the radiation chemistry of aqueous solutions is described. Preliminary data obtained after irradiation are included. Deuteron particles were used to partially or completely destroy the pituitary of rats. Complete details of methods, dose measurements, biological techniques, and results are presented. Body growth and thyroid growth were impaired soon after irradiation at each dose level employed, but degeneration of the testes occurred much later. (C.H.)

46
Atomic Energy Project, Univ. of Rochester
LUMINOUS BACTERIA AS A RADIOBIOLOGICAL TEST ORGANISM, WITH SPECIAL REFERENCE TO THE RADIATIONS FROM A 130-INCH FREQUENCY MODULATED CYCLOTRON. G. Hoyt Whipple. Aug. 25, 1953. 86p. Contract W-7401-eng-49. (UR-249)

The total light emission from a suspension of luminous bacteria (*Achromobacter fischeri*) during an interval of about 8 hr was shown to be a convenient index of biological damage produced by penetrating radiations. Doses as small as 500 r of x rays were measured. This system was used to estimate the biological effectiveness of the high energy radiations from a frequency modulated cyclotron. (auth)

47
Atomic Energy Project, Univ. of Rochester
QUARTERLY TECHNICAL REPORT, APRIL 1 THRU JUNE 30, 1953. Sept. 2, 1953. 26p. (UR-268)

Progress is reported in studies of the part played by bone phosphatase in the calcification process. An investigation

was made of the influence of a number of factors involved in the spontaneous plating of Po from acid solutions. From the results obtained, plating conditions were found such that the standard deviation of a single determination is 5% of the activity present. A soft diet fed to dogs before and after an LD_{50} exposure to x radiation was found to be ineffective in reducing the degree or extent of gastro-intestinal hemorrhage. An exposure to x radiation resulting in a mortality of between LD_{10} and LD_{15} did not sensitize mice to histamine at dosage levels of either 50 mg/kg or 1000 mg/kg given between the 5th and 20th day post-irradiation. Abstracts of papers presented at scientific meetings and a list of technical reports issued during the period are included. (For preceding period see UR-260.) (C.H.)

48
Atomic Energy Project, Univ. of Rochester
STUDIES ON THE PATHOGENESIS OF DEATH DUE TO X-RAY EXPOSURE. 1. ABNORMALITIES OF THE EPINEPHRINE AND NOREPINEPHRINE RESPONSES OF CAROTID ARTERIES OF FASTING DOGS RECEIVING 250 KVP EXPOSURES OF 250 r AND 550 r. W. B. Mason, S. Alpert, and D. J. Smith. Sept. 8, 1953. 17p. Contract W-7401-eng-49. (UR-278)

Carotid arteries from fasting dogs receiving 250 kvp x-ray exposures of 250 r and 550 r responded differently to stimulation with epinephrine and norepinephrine than did arteries from non-irradiated fasting dogs. This difference was demonstrated by angioplethysmography. In the 550-r group, the arteries from one dog were completely unreactive, while the arteries from two other dogs contained both reactive and unreactive segments. Histological examination of the reactive and unreactive segments from the latter animals showed differences suggestive of muscle cell degeneration in the unreactive segments. In both the 250-r and 550-r groups, the reaction time of carotid segments following stimulation by standard amounts of epinephrine and norepinephrine was shorter than that of segments from non-irradiated animals. Fasting per se lengthens the reaction time to epinephrine and norepinephrine. The significance of these observations is discussed. (auth)

49
THE INFLUENCE OF THE SPECTRAL DISTRIBUTION OF RADIANT ENERGY ON THE GROWTH OF THE STRAWBERRY AND BRYOPHYLLUM. B. S. Moshkov. Translated by B[onnie E.] Cushman from Doklady Akad. Nauk S.S.S.R. 75, 593(1951). 5p. (UCRL-Trans-96; AEC-tr-1026)

50
STERILIZATION OF SCREW-WORM FILES WITH X-RAYS AND GAMMA-RAYS. R. C. Bushland and D. E. Hopkins. J. Econ. Entomol. 46, 648-56(1953) Aug.

Experiments were made to determine the effects on adult screw-worm flies, *Callitroga hominivorax* (Coq.), of treating pupae from the laboratory colony with γ rays and x rays. The test insects were irradiated with gamma-rays using a Co^{60} source. Doses were applied with an accuracy of $\pm 10\%$. X ray treatments were applied using a deep-therapy machine. Screw-worms were reared on the standard nutritional medium and were irradiated in the pupal stage. It was found that flies reared from 6-day-old pupae treated with 5,000 r were sterile. Comparisons of three cultures of 6-day-old pupae treated with 5,000 r of x rays or γ rays showed that both radiations produced similar effects. Neither treatment appeared to cause pupal mortality, but adult males from irradiated pupae did not live as long as normal males. Using seven cultures of screw-worm flies, comparisons were made of normal insects with flies from pupae treated with 5,000 r on the sixth day. After 10 to 13 days 56.4% of the normal males were dead. The mean difference, $15.7 \pm 7.0\%$, approached significance

at the 5% level. Sterilization apparently reduced the longevity of the males. During the same period 62.6% of the treated females, but only 47.9% of the untreated females died. There was even greater difference between cultures than in the case of the males, and the mean difference, $14.7 \pm 10.0\%$, was not significant. Most of the female flies irradiated as 6-day-old pupae with 5,000 r of γ rays did not oviposit, and the few that did deposit eggs laid masses less than half as large as those produced by normal flies. With doses of 2,500, 3,000, 3,500, and 4,000 r, pupae were treated after 3, 4, 5, 6, and 7 days \pm 6 hours of development. The highest dose reduced fly emergence of 3- and 4-day-old pupae, but those 5 days or more old emerged as well as the untreated controls. Adult flies, both males and females, from pupae treated on the third and fourth days did not live as long as those treated on the sixth and seventh days. Observations on the hatching of eggs obtained from normal females mated to irradiated males showed that males pupae treated on the sixth and seventh day were not as easily sterilized as were younger pupae. Females showed a similar response in so far as fertility was concerned. It was indicated that no dose of less than 5,000 r could be depended upon to produce total sterility, and that it was best to sterilize pupae after they had completed 5 days of development. When normal and sterilized screw-worm flies were caged together, the γ -irradiated males competed for mates about equally with the normal males. (auth)

51

I. BUDDING AND REGENERATION IN HYDRAS IRRADIATED BY X RAYS. Paul Brien and J.-P. Van Den Eeckhoudt. Compt. rend. 237, 756-8(1953) Oct. 5. (In French)

The *Hydra fusca*, isolated individuals or groups of five or six, placed in 1 mm of water, was irradiated with 4300 r for 10 min. After irradiation the hydras are placed in 120 cm³ of water at a temperature of 19°. Deprived of interstitial cells by the x radiation, the hydra, for about 10 days, maintains a normal appearance. The different epithelial cells continue to divide, and budding and regeneration proceeds normally. The young hydras formed at this time, however, are not viable. Histogenesis and organogenesis have thus been weakened by the cellular differences of the polyp. In order for the hydra to survive and obtain a normal structure, the interstitial cells are indispensable. (J.S.R.)

52

THE DEPOSITION OF ⁹⁰Sr IN RABBIT BONES FOLLOWING INTRAVENOUS INJECTION. Jenifer Jowsey, Barbara Rayner, Margaret Tutt, and Janet Vaughan. Brit. J. Exptl. Pathol. 34, 384-91(1953) Aug.

Observations on the retention and deposition of ⁹⁰Sr in the skeleton of rabbits aged 1 day and 5 to 7 weeks at the time of injection and killed at intervals up to 18 months later are reported. Immediately following injection in both age groups there is localized concentration in areas of active bone growth. In the younger age group such areas of concentration are almost entirely lost by the normal physiological processes of resorption and apposition. In the older group areas of concentration persist. In the older animals the total amount of radioactive Sr retained in the skeleton at any one time is largely that incorporated at the time of injection and to a lesser degree that taken up again from the blood stream after release from the bone by resorption. In younger animals the greater part of the Sr at any time after the first few weeks following injection is probably secondary deposition and is diffuse throughout the bone. Total retention in bones from animals of different age groups may be the same, but the risk of tumor development may be dif-

ferent, since in one age group ⁹⁰Sr occurs largely in localized concentration, while in another deposition is macroscopically diffuse. (auth)

53

STUDY OF THE PHASES OF RADIATION RESPONSE IN THE RAT. L. F. Lamerton, L. A. Elson, and W. R. Christensen. Brit. J. Radiol. 26, 510-18(1953) Oct.

Observations on the growth curves of young rats subjected to single doses of whole-body irradiation clearly indicate the existence of various phases of the radiation response. The initial phase is marked by a period of weight loss for a few days immediately following the irradiation. For doses of radiation up to 500 r or 600 r this phase is then generally followed by a recovery phase, so far as growth rate is concerned. The second period of reaction may then appear at nine to twelve days after irradiation, and is marked by a sudden fall in food intake and loss of weight. The dose of radiation used in the present experiments has for the most part been 400 r or 450 r, and with this dosage level generalized infection is not observed in either period of weight loss. For a given dose of radiation blood counts have not indicated a correlation between the severity of the weight loss in either period and the extent of the fall of the lymphocyte or polymorph count, though with the radiation dose given in these experiments the white cell count has in all cases been reduced to very low levels. However, it has been found that the second weight drop is generally, though not invariably, associated with a severe anemia. For a given dose of radiation the severity of anemia and the frequency of a second weight loss is much greater with younger than with older rats. An investigation with radioactive Fe indicates that the anemia is not entirely the result of gross hemorrhage. In a preliminary investigation it appears that administration of β -mercaptoethylamine as a protective agent may reduce the initial weight drop and reduce the severity of the anemia produced and the likelihood of a second weight drop. (auth)

RADIATION HAZARDS AND PROTECTION

54

Medical Research and Development Board, Office of the Surgeon General

A STUDY OF THE PHYSICAL BASIS OF BURN PRODUCTION WITH APPLICATIONS TO THE DEFENSIVE REACTIONS TO AN ATOMIC BOMB AIR BURST. [nd] 94p. (ATI-165291)

Skin burn phenomena resulting from an atomic bomb air burst are discussed, and ways to reduce their incidence are suggested. Topics discussed include the following: essential features of the burn-producing radiation from an atomic explosion; the influence of the atmosphere on intensity, distribution, and range of the radiation; the protein denaturation hypothesis of burn production; the amount of reaction required for the thermal destruction of the epidermis under any type of heat exposure; the heat flow problems of skin heated by fluids and by radiant energy, as a function of time; the distance from an explosion at which burns will be produced; and the reflectivity of the human skin. Conclusions are applied to military aspects of atomic explosions. The time available for evasive action, the relationship between exposure time and burn area, the effect of rotational movement on burn production, thermal effects of the wind following the shock front, and the effect of background reflection on burn production are discussed. (C.H.)

55

Brookhaven National Lab.

BETA RADIATION DOSAGE MEASUREMENTS. Julia S. Marshall. [nd] 22p. (BNL-1505)

Beta dosage measurements were made using beta-sensitive ionization chambers with the dynamic condenser electrometers. Three of these chambers were constructed and calibrated and placed at various area monitoring stations which are regularly equipped with γ -sensitive dynamic condenser electrometers. Measurements were made over a four-month period in an effort to determine the magnitude of the normal β radiation background and the β component of the dosage from the A^{41} which is present in the cooling air of the reactor. In addition, an attempt was made to observe the pattern of β dosage as a result of temperature inversions. (auth)

56

Oak Ridge National Lab.

REFERENCE WEIGHTED ENERGY FOR RADIUM ²²⁶.

Thomas J. Burnett. Sept. 16, 1953. 8p. (CF-53-9-77)

Since the maximum permissible body burdens of all other α -emitting radioisotopes that are bone seekers are to be based on an energy comparison with Ra^{226} , the effective weighted energy of this standard should be accurately established. Corrections which have been suggested for the equation used in calculating the maximum permissible body burden are discussed, and the modified equation is presented. The total energy and RBE product for Ra^{226} as a standard (on a 70-yr basis) is determined as 161.83. (L.M.T.)

57

Los Alamos Scientific Lab.

SURFACE DOSE RATE FROM MASSIVE PLUTONIUM.

P. R. Schiavone, W. R. Kennedy, and T. N. White. Mar. 16, 1953. 12p. (LA-1574)

Surface dose rates from massive pieces of Pu were measured with an extrapolation chamber under conditions likely to be met in current working practice. The dose rate through 9 to 11 mils of latex plus 30 to 35 mils of neoprene compound was found to be 490 mrep/hr with a standard deviation of 7.2%. Over-all accuracy is probably within 20%. By taking into account possible variations in the work-place setup, a value of 900 mrep/hr is suggested as a reasonable estimate of surface dose rate for monitoring purposes. Measurements through about 11 mg/cm² of cellophane gave a dose rate of 2.16 rep/hr. This value is probably accurate to within 20%. By correlating results with spectrum determinations from other sources, an estimate of the contribution to the surface dose was made for each spectral component. (auth)

58

Research Inst., Univ. of Okla.

STUDIES IN ISOLATION AND IDENTIFICATION OF FLAVONOID PIGMENTS OF USE IN THE CONTROL OF RADIATION INJURY. FINAL REPORT. Simon H.

Wender. [1953] 6p. Contract AT-(40-1)-235. (ORO-101)

Progress is reported in the isolation, identification, and preparation of pure flavonoid compounds. Preliminary studies in the incorporation of C^{14} into the flavonoid compound quercetin, and determination of flavonoids in Florida bovine suprarenal glands are mentioned. No technical data are included. (For preceding report in series see ORO-32.) (C.H.)

59

Isotopes Div., Advisory Field Service Branch, AEC

BASIC SAFETY REQUIREMENTS IN RADIOISOTOPE WORK. G. W. Morgan. p.252-72 of CONFERENCE ON THE USE OF ISOTOPES IN PLANT AND ANIMAL RESEARCH. Apr. 1953. 21p. (TID-5098(p.252-72))

The basic problems involved in the safe handling of radioisotopes and in the safe disposal of radioactive wastes are reviewed. Topics discussed include units of measurement and maximum permissible exposure limits, principles of

protection, surveying and monitoring procedures, design of laboratories for radioisotope work, and the basic principles and problems of disposal of radioactive laboratory waste. (C.H.)

60

Atomic Energy Project, Univ. of Rochester

TREATMENT WITH SUCCESSIVE ANTIBIOTICS OF DOGS EXPOSED TO TOTAL BODY X-IRRADIATION. Molly P.

Coulter and Robert W. Miller. Sept. 8, 1953. 10p. Contract W-7401-eng-49. (UR-276)

Sixty dogs received a total-body exposure to 450 r of 250-kv x rays (LD_{50}). Thirty of these animals received penicillin and streptomycin from the 7th to the 14th days post-irradiation and aureomycin from the 15th to the 21st days post-irradiation. An equal number of dogs served as untreated controls. Fifteen of the 30 untreated dogs died as compared with 3 deaths among the treated animals. Bacteriologic studies frequently showed gram negative organisms in the blood cultures of the sick dogs 24 to 48 hr before death. Under the conditions of this experiment, the use of broad spectrum antibiotics on a schedule contrived to avoid the development of resistant bacteria is, as indicated by statistical analysis, of benefit when administered prophylactically for the acute radiation syndrome in dogs. (auth)

61

Atomic Energy Project, Univ. of Rochester

THE EFFECT OF A PROTEIN FREE DIET ON RECOVERY FROM X-IRRADIATION INJURY IN THE RAT. Milton J.

Schlesinger, Jr. Sept. 11, 1953. 30p. Contract W-7401-eng-49. (UR-279)

The effect of a protein-free diet on recovery from roentgen irradiation has been investigated. Young adult rats exposed to 400 and 250 r of x irradiation one week apart and placed on a protein-free diet immediately after the first irradiation were studied. Response of the animals to this second dose was the criterion used to measure recovery. Results indicate that the protein-deficient diet leads to an increased number of mortalities in the irradiated animals compared to the mortality figures for groups of animals on an 18% casein diet treated in a similar manner. This increase is noted when the mortalities caused by the deficient diet alone and the deficient diet plus single irradiation doses are taken into consideration. These treatments, however, lead to results which obscure a more detailed study of the recovery factors such as an analysis of body and organ weight changes. (auth)

62

Naval Radiological Defense Lab.

THERAPEUTIC EFFECT OF RAT BONE MARROW INJECTION IN RATS EXPOSED TO LETHAL WHOLE-BODY X RADIATION. M. C. Fishler, L. J. Cole, V. P. Bond, and W. L. Milne. Sept. 8, 1953. 26p. (USNRDL-410)

A single intravenous injection of normal homologous rat bone marrow into Sprague-Dawley rats after whole-body x-ray exposure in the lethal and supra-lethal range, 675 to 770 r, elicited a modification in response which was reflected in decreased mortality and enhanced body weight recovery as compared with irradiated control rats. Thus, after injection of 50 to 100 mg of marrow into rats exposed to 700 or 725 r, 70% survived the 30-day observation period, whereas none of the controls survived. At higher radiation dose levels, 750 and 770 r, the administration of larger amounts of bone marrow, e.g., 200 mg per rat, was required for protection. Following 800 r exposure, administration of bone marrow elicited no observable effect on survival or on mean survival time even with a dose of 400 mg marrow per rat. The mean survival time of these animals was approximately 6 days. Forced feeding of aureomycin plus sulfa-

suxidine to rats for a period of 5 days following exposure to 725 r had no effect on survival, nor did this treatment enhance the protective effect of bone marrow. The basis for the relatively greater degree of post-protection by homologous bone marrow in the mouse, as compared with the rat, was discussed. It was proposed that the predominance of the intestinal syndrome (characterized by early deaths) in total-body x-irradiated rats exposed to dose levels of the order of 800 r and higher may constitute the limiting factor for bone marrow therapy in this species. (auth)

RADIOTHERAPY

63

Sloan-Kettering Inst. for Cancer Research
IDENTIFICATION OF THYROGLOBULIN IN HUMAN SERUM AFTER LARGE DOSES OF I^{131} . 2. SEDIMENTATION OF SERUM I^{131} IN THE ULTRACENTRIFUGE. Jacob Robbins, Mary L. Petermann, and J. E. Rall. [1953]. 20p. Contract AT(30-1)-910. (AECU-2725)

The sedimentation of serum I^{131} in the ultracentrifuge was studied in five patients after six doses of radioiodide administered for therapeutic purposes. Four serums contained an abnormal serum iodine component, shown earlier to resemble thyroglobulin. Studies in the preparative ultracentrifuge, and in the analytical ultracentrifuge partition cell, indicated that, although the radioiodine in those serums containing largely thyroxine I^{131} sedimented at a rate close to that of the serum proteins, the abnormal serum iodine component sedimented at a much faster rate. The sedimentation behavior of this material closely resembled that of human and hog thyroglobulin. Estimates of the amount of thyroglobulin in these serums, from the partition cell analyses, gave values which agreed well with those obtained by the salting-out technique. (auth)

TOXICOLOGY STUDIES

64

Chemical Corps Medical Labs., Army Chemical Center
TOXICITY AND PHARMACOLOGY OF BORON HYDRIDES. A STATUS SUMMARY OF WORK PERFORMED UP TO ABOUT JANUARY 1, 1953. J. H. Wills. Feb. 1953. 14p. (AD-8539; Medical Labs. Special Report 15)

The B hydrides (diborane, pentaborane and decaborane) are highly toxic compounds which must be handled with due respect for their toxicity. The chief danger from diborane appears to arise from the local actions of the inhaled gas on the lungs. The chief danger from pentaborane and decaborane probably lies in the production of convulsions. Poisoning by pentaborane and decaborane can occur by absorption from skin and conjunctival surfaces as well as by inhalation. No specific therapy is known for poisoning by any of the B hydrides. Treatment at the present time must be on the symptomatic basis. (auth)

65

Atomic Energy Project, Univ. of Rochester
THE EFFECTS OF PARATHYROID EXTRACT ON THE BONE LESION INDUCED BY BERYLLIUM COMPOUNDS. William Louis Downs. Sept. 11, 1953. 62p. Contract W-7401-eng-49. (UR-271)

Data are reported from a study of the effects of parathyroid extract on bone lesions induced previously by the administration of Be to rats. Under the conditions employed the parathyroid extract failed to induce bone resorption. (C.H.)

TRACER APPLICATIONS

66

California Univ., Davis. [Coll. of Agriculture]
FURTHER STUDIES ON THE AVAILABILITY OF PHOS-

PHORUS IN ALFALFA HAY. G. P. Lofgreen and Max Kleiber. [1953] 10p. (AECU-2706)

A method is described for determining the availability of the P in feedstuffs wherein only one subcutaneous injection of radioactive P need be made. From the 7th through the 13th day the specific activity of the plasma inorganic P and the fecal excretion exhibit a linear relationship with time. This observation enables one to estimate the average specific activity of the plasma inorganic P by drawing blood samples on only the 7th and 13th days. The fecal specific activity is determined on a composite sample collected from the 8th through the 14th day. The ratio of the specific activity of the fecal composite to the mean specific activity of the plasma inorganic P on the 7th and 13th days represents the proportion of the fecal P which is of metabolic origin. By this method it was found that approximately 92% of the fecal P of yearling wethers being fed alfalfa hay was of metabolic origin, and 94% of the P consumed was absorbed. The result indicates a high availability of the P in alfalfa hay. (auth)

67

Laboratory of Pathology, Harvard Cancer Commission
AUTORADIOGRAPHIC ARSENIC LOCALIZATION IN ADULT AND EMBRYONIC EPITHELIUM AND CONNECTIVE TISSUES. Sheldon C. Sommers, Barbara S. Geyer, and Rosanna N. Chute, Laboratory of Pathology, Harvard Cancer Commission and Cancer Research Inst., New England Deaconess Hospital, Boston. [1953] 6p. (AECU-2716)

Autoradiography showed specific localization of As^{73} and As^{74} in adult mouse epidermis and skin adnexa. In tissue cultures embryonic mouse epidermis and chicken fibroblasts both absorbed the radioactive As. Histochemical methods so far developed have evidently not accurately demonstrated the locations of As in tissues. (auth)

68

Sloan-Kettering Inst. [for Cancer Research]
SPECIFICITIES OF THE BINDING TO RABBIT SERUM. David Pressman and Malcolm Siegel. [1953] 20p. (AECU-2723)

The binding of aromatic carboxylate ions by rabbit serum was measured. There appear to be definite specificities of the binding sites for different substances. The specificities are evident from competition experiments in which it was found that the relative effects of various competitor ions are dependent on the nature and concentration of the radiolabeled reference ion used—namely, p-iodobenzoate, 5-iodoisophthalate, and benzoate. (auth)

69

Sloan-Kettering Inst. for Cancer Research
THE SEDIMENTATION BEHAVIOR OF THE THYROXINE-BINDING PROTEIN OF HUMAN SERUM IN THE ULTRACENTRIFUGE PARTITION CELL. Mary L. Petermann, Jacob Robbins, and Mary G. Hamilton. [1953] 20p. Contract AT(30-1)-910. (AECU-2724)

The determination of exact sedimentation rates in the partition cell was adapted to the Spinco ultracentrifuge. The validity of the procedure was checked by studies on bovine serum albumin. The sedimentation rate of the thyroxine-binding protein in whole serum was followed by labeling it with thyroxine containing radioiodine. The sedimentation constant was found to be 3.3 Svedbergs. (auth)

70

Brookhaven National Lab.
THE COMBINATION BETWEEN HEMOLYSINS AND RED CELLS OR GHOSTS, AS STUDIED WITH A RADIOACTIVE LYSIN AND WITH NEW COLOR REACTIONS. Eric Ponder and Ruth V. Ponder, Nassau Hospital. WITH AN APPENDIX ON THE SYNTHESIS OF SODIUM DODECYL SULFONATE- S^{35} . R. Christian Anderson, Brookhaven National Lab. [1953] 27p. (BNL-1550)

Methods for measuring the amount of lysin utilized in reactions between lysins and red cells and ghost red cells are discussed. A radioactive hemolysin, Na dodecyl sulfonate- S^{35} , was prepared, and data on uptake by red cells are presented. Color reactions with anthrone reagent showed that digitonin and saponin are both taken up by red cell ghosts. Data indicate that lysis in systems containing simple hemolysins is a process involving two stages in time and two phases, and that it is usually complicated by reactions between the hemolysin and liberated inhibitory material. (C.H.)

71

Kansas State Coll.

CONFERENCE ON THE USE OF ISOTOPES IN PLANT AND ANIMAL RESEARCH HELD ON JUNE 12, 13, AND 14, 1952. Kansas State Coll. and Argonne National Lab. and Isotopes Div., AEC. Apr. 1953. 276p. (TID-5098)

Separate abstracts have been prepared on 19 sections of this report. (C.H.)

72

Isotopes Div., AEC

SURVEY OF PRESENT USES OF ISOTOPES IN AGRICULTURE. Paul C. Aebersold. p.2-26 of CONFERENCE ON THE USE OF ISOTOPES IN PLANT AND ANIMAL RESEARCH. Apr. 1953. 25p. (TID-5098(p.2.26))

The extent of radioisotope utilization in studies of plant and animal physiology and nutrition during fiscal year 1951 is surveyed. The usefulness of radioisotopes in distribution studies of an element in end products, in isotope dilution analysis, and in activation analysis is reviewed. Data on physical characteristics of available isotopes and possible biological applications of each are summarized. (C.H.)

73

Kansas State Coll.

A TYPICAL TRACER EXPERIMENT. R. H. McFarland and R. E. Hein. p.27-30 of CONFERENCE ON THE USE OF ISOTOPES IN PLANT AND ANIMAL RESEARCH. Apr. 1953. 4p. (TID-5098(p.27-30))

A typical tracer experiment is described in which Ca^{45} was used to determine the ratio of the ionic Ca in chicken blood serum to the Ca combined with protein. The characteristics of Ca^{45} as applied to tracer experiments are reviewed. Methods used for counting the sample, possible sources of error, and necessary health physics practices are described. (C.H.)

74

Bureau of Plant Industry, Soils, and Agricultural Engineering, Dept. of Agriculture

RADIOISOTOPES IN FERTILIZER USAGE, SOIL FERTILITY AND PLANT NUTRITION. Sterling B. Hendricks. p.41-7 of CONFERENCE ON THE USE OF ISOTOPES IN PLANT AND ANIMAL RESEARCH. Apr. 1953. 7p. (TID-5098 (p.41-7))

The applications of radioisotopes in studies of the natural capacities of soils to supply a particular element to plants, in evaluation of the effects of various added sources of the element on a particular soil, and in studies of the passage of nutrient elements through roots are reviewed. Problems involved in the studies are discussed, and steps in carrying out field experiments are outlined. Ninety-four field experiments underway in 1952 are summarized. (C.H.)

75

Washington State Coll.

TRANSLOCATION OF RADIOACTIVE MINERAL NUTRIENTS IN PLANTS. O. Biddulph. p.48-58 of CONFERENCE ON THE USE OF ISOTOPES IN PLANT AND ANIMAL RESEARCH. Apr. 1953. 11p. (TID-5098(p.48-58))

Uses of radioisotopes in studies of the translocation of minerals in plants are reviewed. The idea is presented that the vein extremities in the arterial portion of the plant

may be the site of chemical precipitations which materially interfere with the proper nutrition of the tissues which they supply. It is suggested that, because of the free mobility of P within the plant, foliage applications may be an economical means of application of this element. Mechanisms of translocation of minerals in the phloem are discussed. (C.H.)

76

Bureau of Plant Industry, Soils, and Agricultural Engineering, Dept. of Agriculture

THE MEASUREMENT OF PHOSPHORUS ON THE SURFACE OF SOIL PARTICLES AND ITS RELATIONSHIP TO PLANT AVAILABLE PHOSPHORUS. Sterling R. Olsen. p.59-67 of CONFERENCE ON THE USE OF ISOTOPES IN PLANT AND ANIMAL RESEARCH. Apr. 1953. 9p. (TID-5098(p.59-67))

If $P^{32}O_4$ ions are introduced into a soil-water system, the amount of P^{31} on the surface of the soil particles can be obtained by determining the distribution of P^{32} between the solution and solid phase at near-equilibrium conditions, plus the amount of P^{31} in solution. Plant-available P in the soil was measured by using superphosphate fertilizer tagged with P^{32} . This amount, referred to as "A value," is given by the formula $A = B(1-y)/y$, where B = the amount of P in the fertilizer, and y = the proportion of the P in the plant derived from the fertilizer. A close relationship was found between the plant-available P, or A value, and the amount of surface P in the soil. The correlation coefficient relating these two values was 0.95 for a group of 25 soils. All of the chemical extractants tested in comparison showed lower correlation coefficients, although the P soluble in a Na bicarbonate solution compared favorably with the surface P values. The measurement of surface P in soils may assist in the study of the reactions occurring when a fertilizer is applied to a soil and in developing a better soil test for available P. (auth)

77

Wisconsin Univ.

STUDIES OF BIOLOGICAL NITROGEN FIXATION WITH N^{15} . R. H. Burris. p.68-80 of CONFERENCE ON THE USE OF ISOTOPES IN PLANT AND ANIMAL RESEARCH. Apr. 1953. 13p. (TID-5098(p.68-80))

General techniques for conducting studies with N^{15} as a tracer are reviewed, and certain specific applications of N^{15} in research on biological N fixation are discussed. Tests are described for the ability of organisms to fix N, distribution of N^{15} among nitrogenous compounds in cells, and distribution of N^{15} among the soluble constituents of cells and growth media. Competition experiments in which the N-fixing agent is given the choice of fixing N_2 or using a combined source of N are discussed. (C.H.)

78

Tennessee Agricultural Experiment Station

METABOLISM PROCEDURES AND THEIR SIGNIFICANCE IN RADIOISOTOPE STUDIES WITH FARM ANIMALS. Sam L. Hansard. p.88-98 of CONFERENCE ON THE USE OF ISOTOPES IN PLANT AND ANIMAL RESEARCH. Apr. 1953. 11p. (TID-5098(p.88-98))

Metabolism procedures employing radioisotopes are presented that fulfill the essential basic requirements for balance studies with swine, cattle, and sheep of either sex. Dose levels, administration procedures, and techniques that have proved satisfactory, practical, and adaptable for tracer studies with farm animals are reviewed. Facilities and methods for quantitative separate collection of urine and feces and for blood sampling following radioisotope administration are described. Excreta data for swine, cattle, and sheep following oral and intravenous administration of some of the commonly used isotopes are tabulated. The significance of radioisotope-balance studies for the

interpretation of basic metabolism investigations is discussed. (auth)

79

California Univ., Davis
USE OF P^{32} AS TRACER IN RESEARCH ON METABOLISM AND FOOD UTILIZATION IN INTACT DAIRY COWS. Max Kleiber. p.99-121 of CONFERENCE ON THE USE OF ISOTOPES IN PLANT AND ANIMAL RESEARCH. Apr. 1953. 23p. (TID-5098(p.99-121))

The advantages of using radioisotopes as tracers in metabolic studies are reviewed briefly. Data are presented for the intact dairy cow on P distribution, the distribution of P^{32} , the quantitative importance of various organs is P exchange, the disappearance of P^{32} from plasma, and P^{32} secretion in milk and feces. (C.H.)

80

Michigan State Coll.
ISOTOPES IN HORMONAL AND NUTRITIONAL STUDIES IN ANIMALS. Lester F. Wolterink, Michigan State Coll. and Michigan Agricultural Experiment Station. p.122-54 of CONFERENCE ON THE USE OF ISOTOPES IN PLANT AND ANIMAL RESEARCH. Apr. 1953. 33p. (TID-5098(p.122-54))

General methods applicable to the use of radioactive isotopes as indicators when introduced into the metabolic stream are reviewed. Specific techniques for turnover rate studies and space studies are described in detail. Hormone studies in general are discussed, and details of studies of normal I^{131} thyroid turnover, interrelations between the thyroid and the ovary, the effects of exogenous thyroxine upon the thyroid, techniques for use in studies of factors regulating the development and function of the mammary gland, and the effect of growth hormone on Ca^{45} uptake by bone are described in detail. Specific nutrition studies described include the effects of treatment with thyroxine, thiouracil, on estrogen on Ca^{45} exchange in the skeleton, and studies of the effects of vitamin B_{12} and penicillin on the absorption, disposition, and renal and hepatic blood clearance of Co^{60} . (C.H.)

81

Kansas State Coll.
POULTRY STUDIES WITH ISOTOPES. R. E. Clegg. p.155-61 of CONFERENCE ON THE USE OF ISOTOPES IN PLANT AND ANIMAL RESEARCH. Apr. 1953. 7p. (TID-5098(p.155-61))

Numerous studies employing radioactive isotopes in studies of metabolism and physiology in poultry are reviewed briefly. Tracer studies of the Ca and protein variations in the blood serum of laying and nonlaying hens, and the formation of protein fractions which appear when the hen begins egg production, are reported in detail. (C.H.)

52

Kansas State Coll.
STUDIES OF INSECTS AND INSECTICIDES WITH TRACERS. Paul A. Dahn. p.162-99 of CONFERENCE ON THE USE OF ISOTOPES IN PLANT AND ANIMAL RESEARCH. Apr. 1953. 38p. (TID-5098(p.162-99))

A review is presented of the fast-growing literature dealing with studies of insects and insecticides employing tracers. The literature has been divided into five broad categories: tagging insects and related arthropods with radioelements, physiological studies with insects, biological effects of irradiation, studies relating to medical and veterinary entomology, and the preparation and use of labeled insecticides. Summaries of the observations reported in the literature on the use of radioelements to tag insects and related arthropods and the preparation methods and uses of radioisotope-labeled insecticides and related compounds are presented in tabular form. Experimental

results are presented dealing with the distribution and metabolism of doubly labeled (P^{32} and S^{35}) parathion in the goat and the American cockroach. 149 references. (auth)

83

Argonne National Lab.
UTILIZATION OF C^{14} IN PLANT RESEARCH STUDIES. John Skok. p.200-7 of CONFERENCE ON THE USE OF ISOTOPES IN PLANT AND ANIMAL RESEARCH. Apr. 1953. 8p. (TID-5098(p.200-7))

Counting techniques for the measurement of C^{14} activity are discussed briefly. A number of experiments for the study of C^{14} toxicity in higher plants are reviewed. A brief account of the biosynthesis of C^{14} -labeled dextran is included to illustrate the general utility and methods of handling radiocarbon in biological research. (C.H.)

84

Radiation Lab., Univ. of Calif., Berkeley
STUDIES IN PHOTOSYNTHESIS WITH ISOTOPES. M. Calvin and J. A. Bassham. p.208-26 of CONFERENCE ON THE USE OF ISOTOPES IN PLANT AND ANIMAL RESEARCH. Apr. 1953. 19p. (TID-5098(p.208-26))

The uses of isotopic O, H, C, and P in studies of the reduction of CO_2 to organic compounds during photosynthesis are reviewed. Data are tabulated on the isotopic ratio in O evolved in photosynthesis by Chlorella, the isotopic ratio in O found in xanthophyll from Chlorella exposed to H_2O^{18} , the distribution of radiocarbon in compounds labeled during photosynthesis, and a comparison of C^{14} incorporated into all plant constituents during photosynthesis with that incorporated into soluble compounds. Schematic diagrams of photosynthesis, the path of C from CO_2 to hexose during photosynthesis, and a proposed C cycle for regeneration of two-carbon CO_2 acceptor, are presented. Photographs of radiograms and co-chromatographs of labeled compounds formed during photosynthesis are included. (C.H.)

55

Iowa State Coll.
USE OF C^{14} IN CARBOHYDRATE METABOLISM STUDIES. S. Aronoff. p.227-41 of CONFERENCE ON THE USE OF ISOTOPES IN PLANT AND ANIMAL RESEARCH. Apr. 1953. 15p. (TID-5098(p.227-41))

A selected survey is presented of the uses of C^{14} in investigations of carbohydrate formation during photosynthesis, sucrose formation from monosaccharides in darkness, enzymatic transfer of carbohydrates, glycolytic mechanisms, and the rate of translocation of specific carbohydrates in plants. (C.H.)

CHEMISTRY

86

Louisville Univ.
VISCOSITY BEHAVIOR OF POLYELECTROLYTES. Richard H. Wiley and C. C. Ketterer. [nd] 13p. (AECU-2707)

For 14 different polyelectrolytes, the constant a of the equation $\eta_{sp}/c = ac^b$ (where η_{sp}/c is the viscosity, c is the concentration, and b is the slope of the η_{sp}/c vs. c plot) is equal to 1.34 times the constant D of the equation $\eta_{sp}/c = A/(1 + Bc) + D$, where A and B are constants. Since the constant a is readily evaluated from log-log plots of η_{sp}/c vs. c, it is much more convenient to use than is D in comparing the intrinsic viscosity behavior of polyelectrolytes. (J.S.R.)

87

Sloan-Kettering Inst. for Cancer Research
ON THE NATURE OF XANTHINE AND SUBSTITUTED

XANTHINES IN SOLUTION. Liebe F. Cavaleri, Jack J. Fox, Audrey Stone, and Naishun Chang. [1953?] 15p. Contract AT(30-1)-910. (AECU-2726)

The spectra of a number of methylated xanthines have been determined in aqueous solution as a function of pH and have been found to fall into two distinct categories. Correlation of the spectral shifts with pH has permitted an assignment for the sequence of ionization of the various H atoms. In the case of xanthine, the first ionization is attributed to the removal of the 3-H, while the second is due to the 7-H. When the 3-position is substituted, the 7-H ionizes first, and the 1-H next. When the 1-position is substituted, the order is identical to that of xanthine. If the 7-position is substituted, the sequence is 3, 1. In general, the sequence of ionization of the three positions would be 3, 7, 1. The spectrally determined apparent dissociation constants are found to be in good agreement with those obtained potentiometrically. Contrary to an earlier belief, it has been shown that xanthine, 7-methylxanthine, and xanthosine each exhibit two dissociations in the pH range studied. The relative values of the various apparent dissociation constants are discussed in terms of structure. (auth)

85

Argonne National Lab.

A SURVEY OF THE FREE ENERGIES OF FORMATION OF THE FLUORIDES, CHLORIDES, AND OXIDES OF THE ELEMENTS TO 2500°K. Alvin Glassner. Aug. 1953. 40p. (ANL-5107)

The free energies of formation of oxides, fluorides, and chlorides in the range from 298 to 2500°K were calculated with the aid of the free-energy functions $(F - H_{298})/T$ for the compound and its constituent elements, together with a knowledge of ΔH_{298} , to give $(\Delta F - \Delta H_{298})/T$, where T = the absolute temperature, F = the free energy at temperature T , H_{298} = the heat content at 298.16°K, and ΔH_{298} = the heat of formation at 298.16°K. The free-energy functions themselves were calculated from the values of the heat capacities at constant pressure, the entropies at 298.16°K, and latent heats of transformation. The results of the survey are summarized in tabular form. The data are also presented in terms of free energy vs. temperature diagrams for the various groups of the periodic table for chlorides, fluorides, and oxides separately. (J.A.G.)

89

Argonne National Lab.

ENGINEERING PROPERTIES OF DIPHENYL. Kermit Anderson. Aug. 11, 1953. 27p. Contract W-31-109-eng-38. (ANL-5121)

Data collected from the literature on the vapor pressure, enthalpy, liquid density, and vapor density of pure diphenyl are presented. A Mollier diagram, a temperature entropy diagram, and data on the viscosity of diphenyl as a function of temperature are also presented. Data on the melting points of several binary systems containing diphenyl and for complex mixtures of diphenyl and its pyrolysis products are presented graphically. Graphs of viscosity versus composition at 130C for the systems are also presented. (auth)

90

Brookhaven National Lab.

KINETICS OF THE EXCHANGE OF HYDROGEN BETWEEN PHOSPHINE AND WATER: A KINETIC ESTIMATE OF THE ACID AND BASE STRENGTHS OF PHOSPHINE. Ralph E. Weston, Jr. and Jacob Bigeleisen. [1952] 5p. (BNL-1491)

In a continuation of a program of studies on the rates and equilibria of isotopic exchange reactions, the rate of approach to equilibrium in the exchange between phosphine and H_2O containing 3% D_2O was measured. The experimental procedure and values for the equilibrium constant have been reported previously (*J. Chem. Phys.*, 20, 1400(1952)). (auth)

91

Oak Ridge National Lab.

A PRELIMINARY STUDY OF THE ELECTRICAL CONDUCTIVITY OF STRONG ELECTROLYTES FOR POSSIBLE APPLICATION IN VOLUME HEAT SOURCE EXPERIMENTS. N. D. Greene. May 19, 1953. 9p. (CF-53-5-149)

The conductivity of H_3PO_4 solutions increases with increasing concentration until the solution is 6N. The conductivity of H_2SO_4 solutions is much higher than that of H_3PO_4 solutions, but the conductivity of H_2SO_4 changes more rapidly with temperature than that of H_3PO_4 . (J.S.R.)

92

Ames Lab.

THE CERIUM(IV) SULFATE OXIDATION OF PHENOLS. Walter R. Spencer and Frederick R. Duke. Oct. 29, 1953. 6p. Contract W-7405-eng-82. (ISC-410)

The oxidation products of phenols produced by $Ce(SO_4)_2$ are shown to be dehydrogenated, slightly oxygenated polymers of the original molecules. A rapid quantitative determination of phenol is possible, either volumetrically or gravimetrically, by utilizing the Ce(IV) oxidation reaction. (auth)

93

Knolls Atomic Power Lab.

TWO LIQUID PHASES IN THE LITHIUM-ETHYLAMINE SYSTEM AT 0° C. William H. Howland and Leo F. Epstein. Dec. 16, 1952. 3p. Contract W-31-109-eng-52. (MEMO-WHH-2)

Ethylamine and Li form two liquid phases at 0°C, one blue and the other colorless. The densities of the two phases are nearly equal, but the colorless phase is the denser. If the solvent is dry and air is kept out of the system, no catalyst is needed to initiate the solution of Li in ethylamine. No information was obtained on the composition of the two layers. (J.S.R.)

94

Minerals and Metals Advisory Board, National Research Council

RECONSTITUTED MICA AND SYNTHETIC MICA. Paul M. Tyler. Aug. 27, 1952. 74p. Contract IM-7103. (MMAB-31-C)

Various aspects of the mica industry are surveyed including mining, processing, and fabrication. Particular emphasis has been placed upon investigating reconstituted and synthetic micas for possible uses in delicate and critical electrical equipment. Physical and electrical properties of several ceramic dielectrics are listed. Accomplishments of the Bureau of Mines program of synthesizing fluorine mica are summarized, and some of their properties are presented. It is concluded that, although reconstituted and synthetic micas seem promising, the present demands for the U. S., especially for high-duty capacitors, will have to be met with natural mica for a considerable period in the future. (L.M.T.)

95

Chicago Univ.

HYDRIDES AND BOROHYDRIDES OF LIGHT WEIGHT ELEMENTS AND RELATED COMPOUNDS. TECHNICAL REPORT FOR THE PERIOD AUGUST 1, 1952 TO JULY 31, 1953. H. I. Schlesinger, Martin Steindler, and Grant Urry. Aug. 1, 1953. 41p. Contract N6ori-20, T. O. 10. (NP-4872)

Investigations were made of the solubility of diborane in ethyl ether and the reaction between Li borohydride and borofluoride, the decomposition of di-diethyl etherate of B_2Cl_4 into the mono-etherate and the decomposition of the latter into ethyl chloride, reactions of hydrazine with diborane and related compounds, and pyrolysis of mixtures of diborane and $B(CH_3)_3$. (For preceding period see NP-4249). (J.E.D.)

96 University of Southern Calif.
 PROPERTIES OF SOLUTIONS IN THE NEIGHBORHOOD OF THE CRITICAL TEMPERATURE OF THE SOLVENT. TECHNICAL REPORT, FEBRUARY 1, 1951-JULY 31, 1953. Sidney W. Benson, Charles S. Copeland, Peter E. M. Allen, James K. Fogo, and David Pearson. Aug. 15, 1953. 129p. (NP-4875; Technical Report 3)

A phenomenological study of the critical region which gives limiting laws for the thermodynamic properties of 1- and 2-component systems was presented. An empirical law relating the pressure and the mole fractions on a coexistence isotherm in the critical range has been discovered. From quantitative observations on the phase equilibria in the NaCl-H₂O system, thermodynamic calculations of the partial and apparent molal volumes and compressibilities were made. Calculated entropies and enthalpies in some regions of the 2- and 3-phase equilibrium of the NaCl-H₂O were presented. The electrical properties of this system, the HCl-H₂O system, and the CsCl-H₂O system were discussed. A description of the apparatus used for the conductivity measurements was given. (For preceding report in series see NP-3156.) (J.S.R.)

97 Pennsylvania State Coll. School of Mineral Industries
 KINETICS OF REACTIONS BETWEEN OXIDES IN THE SOLID STATE. Wayne E. Brownell. Aug. 1953. 106p. (NP-4878; Tech. Report 54)

The kinetics of the reactions of MgO, NiO, and ZnO with Al₂O₃ were studied by a quantitative x-ray method. Powdered forms of the oxides were reacted by heating highly compressed mixtures far below their melting points. The product in each case was spinel with the type formula MgAl₂O₄. The reaction between ZnO and Al₂O₃ proceeded at a faster rate than the NiO-Al₂O₃ and MgO-Al₂O₃ mixtures at the same temperature. Precalcination of ZnO and NiO retarded the reaction rates. ZnO with the addition of Ga⁺³ ions reacted more rapidly than ZnO alone or ZnO containing Li⁺ ions. Li⁺ ions increased the reaction rate of NiO. Pb ions, adsorbed on the surface of Al₂O₃, reduced the reaction rate of MgO. The higher reaction rate of ZnO with Al₂O₃ was attributed to the greater polarizability of the Zn⁺² ion as compared to that of the Ni⁺² or Mg⁺² ions. The diffusion of one oxide into the other is not considered part of the reaction mechanism. The increase of reaction rate for ZnO on addition of Ga⁺³ ions and of NiO on addition of Li⁺ ions was explained on the basis of a strained lattice and a semiconducting state. Surface forces were proposed as an important part of the reaction mechanism. (J.S.R.)

98 Wayne Univ.
 FUNDAMENTAL STUDIES ON ELECTRODEPOSITION. Dan Trivich. Aug. 17, 1953. 53p. (NP-4880; Tech. Report 1)

A hypothesis of the mechanism of bright plating was advanced which suggested that the effect of plating brighteners is caused by their adsorption on the cathode. Experiments were performed with an acid Cu bath and with thiourea as brightener. Polarographic studies showed that thiourea, in low concentrations, suppressed the maximum in the Cu polarograph without affecting the half-wave potential or the limiting current. At higher concentrations, thiourea caused a shift in the E_{1/2} to more negative potentials. Plating on single crystals of Cu gave deposits which were matte around the (100) regions and bright in the (111) regions. The addition of thiourea caused the deposits to be uniformly bright over the entire surface. X-ray studies showed that the deposits were polycrystalline in the matte region of the non-bright bath and single-crystal in the (111)

region. The deposits from the bright bath were polycrystalline. The adsorption of thiourea on the Cu single crystal, studied by use of radioactive tracers, was not preferential for any crystal face. Methods of making and processing single crystals of Cu are described. (J.S.R.)

99 Illinois Inst. of Tech.
 SOLID SOLUTION EQUILIBRIA IN THE ZIRCONIUM-HYDROGEN SYSTEM; CHEMICAL THERMODYNAMICS OF MATERIALS AT HIGH TEMPERATURES. R. K. Edwards, P. Levesque, and D. Cubicciotti. Aug. 1953. 28p. (NP-4884; Technical Report 13)

The solubility of H in Zr has been determined as a function of temperature and H pressure in the temperature range 600 to 900°C. The solubilities obtained for a H pressure of 1 atm. are about 10% higher than those obtained by Hall, Martin, and Rees (Trans. Faraday Soc. 41, 306 (1945)). A partial binary phase diagram is presented and correlated insofar as possible with previous x-ray work. In particular, existence of a new phase, δ , in the composition range 59.4 to about 61 at. % H is indicated. The Zr-rich boundary of this phase is invariant with temperature. This phase is apparently separated from the ϵ phase (which includes the composition ZrH₂) by a very narrow 2-phase field which has generally escaped detection and was only indirectly established in this paper. (auth)

100 Illinois Inst. of Tech.
 SOLID SOLUTION EQUILIBRIA IN THE TERNARY SYSTEM ZIRCONIUM-OXYGEN-HYDROGEN; CHEMICAL THERMODYNAMICS OF MATERIALS AT HIGH TEMPERATURES. R. K. Edwards, P. Levesque, and D. Cubicciotti. Aug. 1953. 43p. (NP-4885; Technical Report 14)

The solubility of H in the solid solution of the ternary system Zr-O-H has been determined as a function of temperature, composition, and equilibrium H pressure. The data have been correlated with those of the related binary systems and some previous work in the ternary system, and the solid-state chemistry has been represented by an extensive provisional partial ternary phase diagram. A new single-phase region, δ , lying between the α zirconium and ϵ (approximately ZrH₂) phases has been established as belonging both in the binary and ternary systems. The H saturation boundary of the α phase shows that initially H may be replaced by O on a 3-to-1 basis in the α phase. The H saturation boundary of the δ phase indicates that H may be replaced by O on a 3.5-to-1 basis in the δ phase. (auth)

101 Nuclear Instrument and Chemical Corp.
 BIOSYNTHETIC RADIOACTIVE PRODUCTS AVAILABLE FOR RESEARCH. F. E. Kelsey. p.248-51 of CONFERENCE ON THE USE OF ISOTOPES IN PLANT AND ANIMAL RESEARCH. Apr. 1953. 4p. (TID-5098(p.248-51))

General methods employed in the biosynthesis of radioactive biological products for use in research work are summarized. The relative usefulness of randomly labeled compounds and of partially labeled compounds is compared. (C.H.)

102 Carbide and Carbon Chemicals Co. (Y-12)
 THE VAPOR PRESSURES OF ZIRCONIUM TETRACHLORIDE AND HAFNIUM TETRACHLORIDE. D. W. Kuhn, A. D. Ryon, and A. A. Palko. Jan. 17, 1950. Decl. May 15, 1950. 21p. Contract W-7405-Eng-26. (Y-552)

The vapor pressures of Zr and Hf chlorides were determined over the solid range up to the melting points, and, in the case of ZrCl₄, vapor pressures in the liquid region were also obtained. The melting points were determined also. (auth)

103

ELECTRO-CHEMICAL STUDY OF RADIOACTIVE ELEMENTS. DIVERSE APPLICATIONS. F. Joliot. Translated by Henry P. Kramer from *J. chim. phys.* **27**, 119-62(1930). 67p. (UCRL-Trans-70)

The kinetics of the deposition reaction of Po on polarized Au electrodes have been studied. The apparatus used is described in detail. The speed of deposition can be defined by $dn/dt = kDS/\Delta [N_0 - n/V - an]$, where k is the ratio of the number of collisions favorable to fixation to the total number of collisions of radioactive ions with the electrode, D the coefficient of diffusion of the ions, S the surface area of the electrode, V the volume of the solution, Δ the thickness of the adherent liquid layer, N_0 the number of active cations that are initially in solution, n the number of these which have been discharged by time t , and a the ratio between the concentration of the active ions within the liquid layer adhering to the electrode and the number n . With decreasing electrode potentials the expression becomes $dn/dt = DS/\Delta V (kN_0 - n)$. In nitric medium, the potentials of deposition of the cation and the anion on Au electrodes are +0.37 and 1.12 v. These values are independent of the Po concentration in the range from 10^{-11} to $10^{-8}N$. The speeds of deposition on electrodes of Ag, Cu, and Ni are of the same order as that for Au. Two active cations of different oxidation states were distinguished. One results from the electrolytic dissociation of Po salt obtained in NO_3^- , SO_4^{2-} , $C_2H_3O_2^-$, and HCl media. The other is formed in a reducing medium such as $H_2C_2O_4$ and H_2O_2 in acid. In a strongly oxidizing medium almost all of the Po is deposited on the anode, but a reducing medium impedes anode deposition. Several new determinations of the deposition potentials of the inactive metals Bi and Te were performed in acidic or neutral media. For Bi the electrochemical potential is -0.05 ± 0.01 v, and for Te it is -0.011 v. (J.S.R.)

104

FLUORESCENCE OF MAGNESIUM PHTHALOCYANINE AND CHLOROPHYLL IN VARIOUS STATES. V. F. Gachkovskii. [Translated by] A. N. Bahk from *Doklady Akad. Nauk S.S.S.R.* **73**, 963-6(1950). 11p. (UCRL-Trans-87)

105

THE QUESTION OF THE CHLOROPHYLL-PROTEIN COMPLEX. O. P. Osipova and I. V. Timofeeva [Timofeyeva]. *Doklady Akad. Nauk S.S.S.R.* **74**, 979-81(1950). (UCRL-Trans-89)

106

RADIOACTIVITY. ON THE VAPORIZATION OF POLONIUM. P. Bonet-Maury. Translated by Henry P. Kramer from *Compt. rend.* **184**, 1376-8(1927). Feb. 14, 1950. 4p. (UCRL-Trans-50)

Po, supported by a Ni wire, is volatilized by heat applied in a vacuum. The Po atoms are distributed in space according to Lambert's law of cosines, i.e., the number of atoms vaporized into a vanishingly small element of solid angle about a given direction is proportional to the cosine of the angle of this direction with the normal of the emitting surface. (J.S.R.)

107

OXIDATION OF ETHYLENE AND ETHYLENE OXIDE ON DIFFERENT CATALYSTS. (Okislenie Etilena i Okisi Etilena na Razlichnykh Katalizatorakh.) O. M. Todes and T. I. Andrianova. Translated by R. Cvetanović and G. Belkov from *Doklady Akad. Nauk S.S.S.R.* **88**, 515-18(1953). 9p. (TT-387)

The oxidation rates of ethylene and ethylene oxides obtained with Mg-Cr, Cu-Cr, and Ag as oxidizing catalysts are compared at various temperatures. (J.A.G.)

108

ON EQUILIBRIUM OF LIQUID MIXTURES AND SOLUTIONS. [PART] 1. V. A. Kireev and A. A. Popov. Translated by G. Belkov from *Zhur. Priklad. Khim.* **7**, 489-94(1934). 16p. (TT-398)

109

CRYSCOPIC CONSTANTS AND CONVERSION TEMPERATURES OF N-ALKANES C_4 - C_{20} . M. D. Tilicheev, V. P. Peshkov, and S. A. Yuganova. Translated from *Zhur. Obshchei Khim.* **21**, 1229-37(1951). 11p. (ATI-153667)

110

FLUORIDE COMPLEXES OF TITANIUM IN SOLUTION. K. E. Kleiner. Translated from *Zhur. Obshchei Khim.* **22**, 17-23(1952). 6p. (AERE-Trans-11/3/5/333)

A brief abstract of this report appears in *Nuclear Science Abstracts* as NSA 6-3226.

111

THE ENZYMATIC HYDROLYSIS OF THE CRYSTALLINE PROTEIN OF SKIN. V. N. Orekhovich, A. A. Tustanovskii, and K. D. Orekhovich. Translated from *Doklady Akad. Nauk S.S.S.R.* **57**, 475-7(1947). 4p. (AERE-Trans-11/3/5/340)

112

ULTRAFILTERS OF CARBORUNDUM. Jacques Duclaux and Miguel Amat. Translated by Margaret L. Schloo from *Compt. rend.* **205**, 315-6(1937). Sept. 14, 1953. 2p. (AEC-tr-1700)

The qualities of materials which are necessary for ultra-filtration applications are briefly discussed. Carborundum, treated by levigation, yields finer grain sizes and satisfies most of the necessary conditions. Suspensions of 3 different grain sizes (3, 0.6, and 0.3μ mean diameters) in slightly ammoniacal H_2O were prepared for use and poured over a Jena glass filter. The performance of the respective layers in holding back three types of colloidal solutions was then investigated. It is thought that, with refinements in the preparation technique, carborundum can be gainfully used as an ultrafilter. (L.M.T.)

113

THE MUTUAL EXCHANGE OF THE HYDROGEN ATOM BETWEEN WATER AND ACETONE. Karl Schwarz and Herbert Steiner. Translated by Margaret VanNess from *Z. Physik. Chem.* **B25**, 153-6(1934). Jan. 4, 1952. 6p. (AEC-tr-1701)

114

THE KINETICS OF THE DISSOCIATION OF PYRITE. V. S. Udintseva and G. I. Chufarov. Translated by E. Rabkin from *Zhur. Priklad. Khim.* **14**, 3-10(1941). 24p. (TT-371)

115

OVERCHARGING OF NEGATIVE IONS Na^+ , K^+ , O^- , OH^- , AND O_2^- WITH MOLECULES OF OXYGEN. V. M. Dukelskii [Dukelsky] and E. Y. Zandberg [Sandberg]. Translated from *Doklady Akad. Nauk S.S.S.R.* **82**, 33-6(1952). 7p. (AEC-tr-1707)

116

RADIOACTIVITY—ON THE VAPORIZATION OF POLONIUM IN VACUO. P. Bonet-Maury. Translated by Henry P. Kramer from *Compt. rend.* **187**, 115-7(1928). Jan. 14, 1950. 3p. (UCRL-Trans-51)

A brief discussion of the method employed in measuring the quantity of Po vaporized at a constant temperature as a function of time and a description of the apparatus used are presented. (J.E.D.)

117

SALTS AND COMPLEXES OF NITRIL-TRI-ACETIC ACID. H. Brintzinger and G. Hesse. Translated by Henry P. Kramer from *Z. anorg. Chem.* **249**, 299-307(1942). 12p. (UCRL-Trans-79)

118

INORGANIC PEROXIDES. 11. THE HIGHER OXIDES OF POTASSIUM. I. A. Kazarnovskii and S. I. Raikhshtein. Translated by Bonnie [E.] Cushman from *Zhur. Fiz. Khim.* **21**, 245-55(1947) 16p. (UCRL-Trans-99; AEC-tr-1029)

The oxides KO_2 , RbO_2 , and CsO_2 and the molecular ion O_2^- were examined. Tensimetric investigations and density and refractive measurements showed that only three oxides of K exist: K_2O , K_2O_2 , and KO_2 . The K_2O_3 reported by some investigators is a mixture of K_2O_2 and KO_2 . The crystal structures of KO_2 , RbO_2 , and CsO_2 were determined. The heat of formation of K_2O_2 was found to be 117.0 kcal. (J.S.R.)

119

VAPOR PRESSURE OF SILICON MONOXIDE. P. V. Gel'd and M. I. Kochnev. Translated from *Doklady Akad. Nauk S.S.S.R.* **61**, 649-52(1949). 8p. (UCRL-Trans-28)

The vapor pressure of synthetic SiO , obtained by the reaction $\text{Si(s)} + \text{SiO}_2\text{(s)} \rightleftharpoons 2\text{SiO(g)}$, was studied. Since SiO possesses a comparatively small vapor pressure, determinations were carried out by the molecular effluence method. Calculated results were checked against the vapor pressure measurement of KCl . Consideration is also given to the inclination of SiO toward reversed adsorption and the comparison of the experimentally determined heat of sublimation of the compound with known thermochemical figures. (J.A.G.)

120

THE PREPARATION OF LITHIUM HYDRIDE. P. Albert and J. Mahe. Translated by Margaret VanNess from *Bull. soc. chim. France* **17**, 1165-7(1950). July 27, 1953. 6p. (AEC-tr-1689)

An apparatus is described for the preparation of kilogram quantities of LiH with a yield of about 99.6% in an 8-hr operation. The apparatus includes, essentially, a reaction tank of mild steel to which 2 Fe tubes are soldered, permitting the circulation of a stream of commercial electrolytic H_2 , the flow of which is regulated by means of droplets of H_2SO_4 . The speed of the reaction of Li with H_2 between 650 and 700°C and with a contact surface of 110 cm^2 was calculated to be 1.5 $\text{cc/cm}^2/\text{sec}$. The LiH obtained was largely tinged in blue, easily crystallized, and very hard. It was believed that the coloration was due to a slight excess of Li in comparison with the stoichiometric composition of the hydride. A microscopic study of the boats used showed that Li is easily able to diffuse through the grain boundaries of Fe and is thus able to traverse a 2-mm thickness of Fe in 4 hr, especially if the temperature is raised above 700°C. (J.A.G.)

121

THE IMPROVEMENT OF THE PROPERTIES, ESPECIALLY THE SCATTERING POWER, OF NICKEL BATHS WITH THE HELP OF SULFUROUS ACID AND ITS SALTS. H. Komusaari. Translated by Margaret L. Schloo from *Metallüberfläche* **4**, 162-3(1952). Sept. 21, 1953. 2p. (AEC-tr-1702)

Ni, deposited electrolytically, is dark or else fails completely to deposit at spots where the current density is low. Addition of 50 to 100 mg/l of SO_2 (as MgSO_3) improves the quality of the deposition and does not impair the luster of the Ni. (J.S.R.)

122

PROTON RELAXATION PHENOMENA IN COMPLEX ION FORMATION. J. R. Zimmerman. *J. Chem. Phys.* **21**, 1605(1953) Sept.

The influence of the presence of oxalic acid on the relaxation times of protons in aqueous solutions of V^{+4} is reported. (J.A.G.)

123

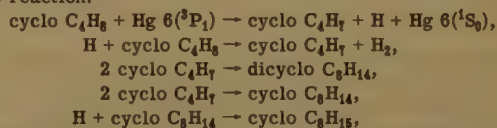
THE REACTION OF PEROXIDES AND HYDROPEROXIDES WITH LITHIUM ALUMINUM HYDRIDE. Glen A. Russell. *J. Am. Chem. Soc.* **75**, 5011-3(1953) Oct. 20.

Hydroperoxides and polymeric peroxides are much more reactive toward lithium aluminum hydride than are most monomeric dialkyl peroxides. A stepwise chain degradation involving cyclic intermediates has been proposed to explain the facile reduction of polymeric peroxides to glycols. Lithium aluminum hydride will not readily catalyze the basic decomposition of peroxides containing an α -hydrogen atom activated by a phenyl group. (auth)

124

THE REACTION OF CYCLOBUTANE WITH $\text{Hg } 6(^3\text{P}_1)$ ATOMS. D. L. Kantro and H. E. Gunning. *J. Chem. Phys.* **21**, 1797-1801(1953) Oct.

The reaction of cyclobutane with $\text{Hg } 6(^3\text{P}_1)$ atoms has been studied in a static system at $30.10 \pm 0.01^\circ\text{C}$, over the pressure range from 2 to 250 mm. The primary products of the reaction are H_2 , n-butylcyclobutane, and a saturated C_8H_{14} product which is assumed, from kinetic and mass spectral evidence, to be cyclobutylcyclobutane. In addition, prolonged exposure produced a saturated $\text{C}_{12}\text{H}_{22}$ product which is probably a dicyclobutylbutane. The quantum yields of pressure decrease (ϕ_P), H_2 formation (ϕ_{H_2}), and cyclobutane consumption (ϕ_C) all reach constant maximum values at cyclobutane pressures greater than approximately 100 mm. These values are $\phi_C = 0.53$, $\phi_{\text{H}_2} = 0.10$, and $\phi_P = 0.16$. From the simple stoichiometry of the reaction the quantum yields of n-butylcyclobutane (ϕ_{BC}) and cyclobutylcyclobutane (ϕ_{C_2}) formation were calculated. From the data $\phi_{\text{BC}} = 0.16$ and $\phi_{\text{C}_2} = 0.10$. The following mechanism was found to be consistent with the observed characteristics of the reaction:



$\text{cyclo } \text{C}_8\text{H}_{15} + \text{cyclo } \text{C}_4\text{H}_8 \rightarrow \text{cyclo } \text{C}_4\text{H}_7 + \text{cyclo } \text{C}_8\text{H}_{16}$, where dicyclo C_8H_{14} represents cyclobutylcyclobutane; cyclo C_8H_{14} , cyclobutylbutene; cyclo C_8H_{15} , cyclobutylbutyl radicals; and C_8H_{16} , n-butylcyclobutane. The cyclobutylbutene is considered as an intermediate in the formation of the stable n-butylcyclobutane product. (auth)

125

THE DIFFERENTIAL DIFFUSION COEFFICIENT OF STRONTIUM CHLORIDE IN DILUTE AQUEOUS SOLUTION AT 25° . Herbert S. Harned and Francesco M. Polestra. *J. Am. Chem. Soc.* **75**, 4168-9(1953) Sept. 5.

The differential diffusion coefficient of strontium chloride between 0.001 and 0.008 M concentrations at 25° has been determined by the conductometric method. Good agreement with calculations by the Nernst-Onsager and Fuoss theoretical equations has been obtained. This result differs from the behavior of the diffusion coefficient of calcium chloride which appears to deviate widely from the theoretical prediction in solutions of the same concentrations. (auth)

AEROSOLS

126

General Electric Research Lab.
PRODUCTION OF MONODISPERSE LIQUID PARTICLES BY ELECTRICAL ATOMIZATION. (PROJECT CIRRU). OCCASIONAL REPORT NO. 36. Bernard Vonnegut and Raymond L. Neubauer. Oct. 1, 1952. 6p. Contract DA-36-039-sc-15345, Seventh Occasional Report. MULTIPLE-STAGE DILUTION OF AEROSOLS BY USE OF ASPIRATORS.

(PROJECT CIRRUS). OCCASIONAL REPORT NO. 37.

Bernard Vonnegut, Myer Geller, and Kiah Maynard. Oct. 1, 1952. 3p. Contract DA-36-039-sc-15345, Eighth Occasional Report. (RL-747; Occasional Report 7; Occasional Report 8; Occasional Report 36; Occasional Report 37).

Streams of highly electrified uniform droplets about 0.1 mm in diameter were produced by applying potentials of 5 to 10 kv a-c or d-c to liquids in small capillaries. Monodisperse aerosols having a particle radius of one μ or less were formed when the capillary was positively charged and liquids having low electrical conductivity were used. Aerosols formed in this way showed the colors of higher order Tyndall spectra. A drawing of the apparatus is included. An apparatus was developed for the purpose of rapidly diluting aerosols of very high concentrations of small particles, such as condensation nuclei. It is described and illustrated photographically. (auth)

ANALYTICAL PROCEDURES

127

Oak Ridge National Lab.

THE DETERMINATION OF TRACE AMOUNTS OF URANIUM BY NEUTRON ACTIVATION ANALYSIS. H. A. Mahlman and G. W. Leddicotte. Issued Aug. 24, 1953. Decl. Oct. 20, 1953. 20p. (AEC-3592; ORNL-1590)

The determination of trace concentrations of U in synthetic materials, ores, soils, and water by neutron radioactivation analysis is described. The principles of the activation analysis method as applied to trace U determination, the processing of irradiated specimens, and some examples of the results obtained by this method of analysis are discussed. (auth)

128

Louisiana State Univ.

CHROMATOGRAPHIC STUDIES. FINAL REPORT. July 1952. 99p. (NP-4835; ATI-171794)

Manuscripts of papers (which are being prepared for publication) on indirect determination of R values from chromatography on C, survey of some solid adsorbents, role of the solvent in chromatography, steric factors in disubstituted benzenes, streak reagents for chromatography, and effect of side chain and fused rings on color developed with formaldehyde- H_2SO_4 reagent are presented. (J.S.R.)

129

Atomic Energy Project, Univ. of Rochester

SOME ERRORS IN THE DETERMINATION OF CALCIUM IN BLOOD SERUM. P. S. Chen, Jr. and T. Y. Toribara. Oct. 12, 1953. 9p. Contract W-7401-eng-49. (UR-285)

Errors in the measurement of the Ca in biological material by precipitation as Ca oxalate followed by titration of the oxalate are manifold. The principle sources of error are the non-specificity of the oxidizing agent, the incompleteness of Ca precipitation, and the contamination of the precipitate by oxalates other than Ca. The direct measurement of the Ca by flame photometry of acidified solutions from which protein has been removed eliminates most of the errors. (auth)

130

THE DETERMINATION OF LITHIUM OXIDE. [A. Carnot]. Translated from Z. anal. Chem. **29**, 232-5(1890). 6p. (AEC-tr-1718)

A. Carnot's method (AEC-tr-1717) for the determination of lithia by fluoride precipitation is reviewed. (J.S.R.)

131

COLORIMETRY IN A TURBID MEDIUM. A. Dognon.

Translated by Margaret VanNess from Compt. rend. **135**, 113-5(1941). Aug. 3, 1953. 2p. (AEC-tr-1684)

Two methods are described for elimination of the influence of turbidity of the medium during colorimetric

analysis. One method, used in connection with the diffusio-absorptiometer, makes use of an annular lighting arrangement of the cell, an adjustable diaphragm placed in front of this, and an opaque-pastil between this and the cell. The presence of a turbid medium allows a recovery of light, and an empirical adjustment on the absorption due to turbidity is exactly compensated. The second arrangement, which employs a spherical colorimetric integrator, is said to give a more satisfactory solution to the problem. The integrator is described, and a diagrammatic drawing is included. (C.H.)

132

THE CHEMISTRY OF SEA WATER. THE ELEMENTS PRESENT IN TRACE QUANTITIES. H. Wattenberg. Translated from Z. anorg. u. allgem. Chem. **236**, 339-60(1938). 13p. (AERE-Trans-11/3/5/352)

Factors affecting the constancy of the concentration of minerals in sea water are discussed. Methods used for estimating the concentration of elements and compounds present in traces in sea water are reviewed. The literature on trace elements in sea water is reviewed briefly, and published data on the concentration of 25 elements are presented in tabular form. (C.H.)

133

ANALYSIS WITH HIGH FREQUENCY FIELDS. W. van Tongeren. Translated from Chem. Weekblad **47**, 281-7(1951). 20p. (AEC-tr-1698)

Potentiometric, amperometric, and conductometric titrations have the common disadvantage that the electrode must be immersed in the liquid. The accuracy of the titration may be diminished by reaction of the electrode with the solution, inhomogeneity of the electrodes, and the polarization phenomena. By the use of high frequency fields the electrodes may be placed outside the solution, and small changes in the solution will create a great effect on the electric properties of the field. Instruments used for high-frequency titrations are described. (J.S.R.)

134

A RAPID METHOD FOR QUALITATIVE ANALYSIS: I. SOME SPECIFIC REACTIONS OF ORDINARY CATIONS AND ANIONS. Grégoire Gutzeith. Translated by Margaret VanNess from Helv. Chim. Acta **12**, 713-40(1929). Nov. 26, 1952. 31p. (AEC-tr-1681)

A list of methods is presented which are especially notable for speed in the qualitative determination of anions and cations. (J.E.D.)

135

THE AMINO-ACID COMPOSITION OF OXPROCOLLAGEN. M. P. Chernikov. Translated from Doklady Akad. Nauk S.S.S.R. **67**, 245-7(1949). 4p. (AERE-Trans-11/3/5/339)

136

THE COLORIMETRIC DETERMINATION OF TRACES OF BORON IN HEAVY WATER. C. Fizzotti and L. Selmi. Translated by E. Ubaldi from Chimica e industria (Milan) **34**, 265-6(1952). 3p. (AEC-tr-1690)

A rapid colorimetric method is described for the microdetermination of B in D_2O , based on the measurement of pH variation which is demonstrated by the addition of mannite in a H_2O solution containing traces of boric acid (0.1 to 0.6 γ /cc). (auth)

137

A NEW METHOD FOR THE DETERMINATION OF LITHIUM OXIDE BY MEANS OF FLUORIDES. A. Carnot. Translated from Bull. soc. chim. Paris (3), **1**, 280-3(1889). 5p. (AEC-tr-1717)

The limited solubility of LiF in comparison with the much greater solubility of NaF or KF is utilized in a gravimetric determination of lithia in mineral waters. The sample is evaporated to a small volume, and NH_4F and excess

NH₄OH are added. LiF precipitates, and the supernatant liquid is decanted. The volatile material is driven off by heating the residue slightly. A few drops of H₂SO₄ are added, and the solution is evaporated to dryness. The Li₂SO₄ is weighed. (J.S.R.)

138

THE REACTION OF NITRITES WITH AMINO-SULFONIC ACID AND AN IDENTIFICATION AND DETERMINATION OF NITROUS ACID IN THE PRESENCE OF NITRIC ACID.

Paul Baumgarten and Ilse Marggraff. Translated by M. Schloo from *Ber. deut. chem. Ges.* **63**, 1019-24(1930). 8p. (AEC-tr-1678)

Amino-sulfonic acid reacts instantaneously with nitrites to evolve N₂ and to form the bisulfate. This reaction can be used for the quantitative determination of NO₂⁻ by precipitating the HSO₄⁻ with Ba. NO₂⁻ can be determined by reducing it to HNO₂ with Zn or Mg chips. (J.S.R.)

139

OBSERVATION ON THE DETERMINATION OF NITROGEN IN GASEOUS MIXTURES. L. Chopin. Translated by Margaret VanNess from *Ann. chim. anal.* **28**, 32(1946). June 17, 1953. 4p. (AEC-tr-1680)

Methods for the determination of N₂ in gaseous mixtures are criticized, and the causes of inaccuracy are indicated. The Dumas method of passing the gas over hot CuO and absorbing the CO₂ in caustic alkali will give reproducible results if the gas is passed over two tubes of CuO. Mg can also be used to absorb N₂. (J.S.R.)

140

DETERMINATION OF ACTIVE HYDROGEN BY GRIGNARD'S REAGENT IN AN ATMOSPHERE OF CARBON DIOXIDE. (Opredelenii aktivnogo vodoroda reaktivom Grin'yara v atmosfere uglekislogo gaza.) A. P. Terent'ev and K. D. Shcherbakova. Translated by G. Belkov from *Zhur. Obshchei Khim.* **10**, 2041-6(1940). 1953. 17p. (TT-376)

A method has been developed for determining active H with a Grignard reagent in an atmosphere of CO₂. The methane is liberated in the reaction vessel and transferred to an azotometer with a stream of CO₂. The amount of CH₄ is measured with an eudiometer. The results of the analysis of organic compounds for activated H are tabulated. (J.S.R.)

141

NEUTRON-ACTIVATION DETERMINATION OF PHOSPHORUS IN PAPER ELECTROPHOROGRAMS. Kurt Schmeiser and Dietrich Jerchel. *Angew. Chem.* **65**, 490-1(1953) Oct. 7. (In German)

Chemical compounds can be detected and determined quantitatively by the neutron-induced radioactivity of their paper chromatograms. The determination of casein is used as an example, and the isolation of the Si³¹ activity caused by the P³¹(n,p)Si³¹ reaction from interfering activities by decay measurements is described. (G. Y.)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

142

Iowa State Univ.

THE CRYSTAL STRUCTURE OF NaHg₂, NaHg and Na₃Hg₂. J. W. Nielsen and N. C. Baenziger. [1953] 26p. Contract AT(11-1)-72. (AECU-2727)

The crystal structures of NaHg and Na₃Hg₂ have been determined from Weissenberg and precession-camera data. NaHg is end-centered orthorhombic, a = 7.19 Å, b = 10.79 Å, c = 5.21 Å, Z = 8. Pairs of Hg atoms are grouped in ribbons which extend through the crystal. Na₃Hg₂ is tetragonal with a = 8.52 Å, c = 7.80 Å, Z = 4. Hg atoms are in isolated groups of four with a nearly square arrangement. From powder diagrams NaHg₂ was found to be the hexagonal AlB₂ type with a = 5.029 Å, c = 3.230 Å. (auth)

DEUTERIUM AND DEUTERIUM COMPOUNDS

143

Los Alamos Scientific Lab.

SOME PHYSICAL PROPERTIES OF THE DEUTERO-GERMANES. Alfred H. Zeltmann and George C. Fitzgibbon. [1953?] 6p. (AECU-2720)

Vapor pressure data for the deuterated mono-, di-, and tri-germanes have been determined. From these data the latent heats of vaporization were calculated. The melting points, boiling points, and liquid densities were also determined. (auth)

144

ACCUMULATION OF HEAVY WATER BY COUNTER-CURRENT ELECTROLYSIS. Hans Martin and Eva Ruhtz. Translated by J. A. E. Prochnow from *Z. Elektrochem.* **54**, 560-6(1950). Apr. 16, 1951. 14p. (AEC-tr-1687)

An attempt to accumulate D₂O according to an electrochemical exchange process is described. Ten percent H₂SO₄ was used as electrolyte liquid. In a 19-hr experiment, the H₂ contained in the anode liquid (about 32 cc) in the form of H₂O and H₂SO₄ was concentrated from the original 6.88 mole % D to 7.22 mole % D, with a current strength of 0.55 amp. The effective "individual separation factor" of ~2.2 calculated from a total of three measured concentration shifts agrees in all cases. The different mobility of protons and deuterons alone can, at the maximum, explain an individual separation factor of $\sqrt{m_D/m_H} = 1.4$. It is found that the value obtained is produced by interaction of a migration-speed effect with at least one chemical exchange effect. (auth)

145

THE EXISTENCE OF MULTIPLY CHARGED MOLECULAR IONS OF HBr, HCl, AND DCl. W. H. Johnston. *J. Chem. Phys.* **21**, 1499-1502(1953) Sept.

Experimental evidence is presented for the DCl⁺¹, HCl⁺¹, DCl⁺², and HBr⁺² molecular ions, using a modified Consolidated-Nier mass spectrometer. Although Cl⁺³, Br⁺³, and A⁺³ were observed, no evidence was obtained for H⁺¹Cl⁺², or HBr⁺² above Z = 2. This result contradicts the recent calculations of Magee and Gurnee that HBr⁺³ and HBr⁺⁴ would be stable toward dissociation. Finally, a crude calculation is done, assuming H is atomic orbitals, which agrees amusingly with experiments. (auth)

FLUORINE AND FLUORINE COMPOUNDS

146

National Bureau of Standards

THERMAL DEGRADATION OF PERFLUORO- AND HYDROFLUORO-ETHYLENE POLYMER IN A VACUUM. PROGRESS REPORT. S. L. Madorsky, V. E. Hart, S. Straus, and V. A. Sedlak. June 15, 1953. 28p. (NBS-5A-172)

Teflon and tetrafluoroethylene photopolymers, on pyrolysis in a vacuum at 423.5 to 513.0°C, yield almost 100% monomer. Rate of formation of monomer at any given temperature follows a first-order reaction and is independent of method of preparation of polymer or its initial average molecular weight. The activation energy was determined by a pressure method and a weight method, and a value of 80.5 kcal was found by both methods. A preliminary heating of Teflon in air at 400 to 470°C did not change appreciably its rate of degradation into monomer when it was subsequently heated in a vacuum. Polyvinyl fluoride, 1,1-polyvinylidene fluoride, and polytrifluoroethylene were pyrolyzed in the temperature range 372 to 500°C. The volatiles consisted in all cases of HF and a waxlike material consisting of chain fragments of low volatility. Polyvinyl fluoride and polytrifluoroethylene degrade to complete volatilization, while 1,1-polyvinylidene fluoride becomes stabilized at about 70%

loss of weight. The rate-of-volatilization curves indicate a first-order reaction for polyvinyl fluoride, a zero-order reaction for trifluoroethylene and an undetermined order for 1,1-polyvinylidene fluoride. The order of thermal stability for these polymers, as compared with polymethylene, is as follows: polyvinyl fluoride < polymethylene < polytrifluoroethylene < 1,1-polyvinylidene fluoride < polytetrafluoroethylene. (auth)

147

National Bureau of Standards

PROPERTIES OF FLUORINE COMPOUNDS: THE VIBRATIONAL SPECTRA OF TETRAFLUOROETHYLENE AND TETRACHLOROETHYLENE. D. E. Mann, National Bureau of Standards and N. Acquista and Earle K. Plyler, Atomic Physics Lab., National Bureau of Standards. [1953] 30p. Contract NAonr 112-51. (NBS-2618)

The infrared spectra of gaseous tetrafluoroethylene from 22 to 52 μ and liquid tetrachloroethylene from 3 to 52 μ have been determined. Several hitherto unobserved bands were found. New and satisfactory assignments, for which a detailed discussion is given, have been achieved. The out-of-plane force constants are discussed and used to predict the wagging and torsion frequencies of tetrabromoethylene. Tables of the thermodynamic functions for tetrafluoro- and tetrachloroethylene are presented. (auth)

148

New Hampshire Univ.

PROGRESS REPORT. Helmut M. Haendler. Aug. 1, 1953. 37p. (NYO-3534)

A Ni still for purification of BrF_3 was built and put into operation. Distillation is carried out at atmospheric pressure in an atmosphere of He. Measurements on ultraviolet spectra of the purified BrF_3 were made in perfluoroheptane, as vapor and as liquid. A study was made of the Br band in the trifluoride spectrum. An apparatus for freezing-point studies of solutions in BrF_3 was constructed. The BrF_3 end of the systems BrF_3 - BaF_2 and BrF_3 - NaF was studied. A study was made of the feasibility of using ultraviolet absorption for detection and determination of UF_6 in gas streams. The method appears highly practical. (auth)

149

SUBSTITUTED METHANES. XV. INFRARED SPECTRAL DATA, ASSIGNMENTS, AND CALCULATED THERMODYNAMIC FOR FLUOROTRICHLOROMETHANE. Richard B. Bernstein, James P. Zietlow, and Forrest F. Cleveland. *J. Chem. Phys.* 21, 1778-80(1953) Oct.

Infrared spectral data for gaseous CCl_3F have been obtained in the region 400 to 3200 cm^{-1} , by using NaCl and KBr prisms. The present data are compared with previous Raman and infrared data, and assignments and calculated wave numbers are given. The fundamentals (=liquid) are $\nu_1(a_1)$ 1085, $\nu_2(a_1)$ 534, $\nu_3(a_1)$ 351, $\nu_4(e)$ 846, $\nu_5(e)$ 400, and $\nu_6(e)$ 245 cm^{-1} . Thermodynamic properties were calculated for 17 temperatures from 100 to 1500°K and were compared with previous calorimetric results. (auth)

150

EQUILIBRIA INVOLVING THE $\text{CF}(g)$ AND $\text{CF}_2(g)$ RADICALS AT HIGH TEMPERATURES. John L. Margrave and Karl Wieland. *J. Chem. Phys.* 21, 1552-4(1953) Sept.

The absorption spectrum of CF_4 gas thermally decomposed under equilibrium conditions in a graphite tube furnace, shows the bands of CF_2 at a temperature $T \approx 1900^\circ\text{K}$ and also the bands of CF at a temperature $T \approx 2400^\circ\text{K}$. These results are in approximate agreement with thermodynamic calculations made by Potocki and Mann when the high value of 170 kcal/mole for the heat of sublimation of graphite and when f values of about 10^{-3} for both the CF_2 and the CF bands are assumed. (auth)

151

BOND MOMENTS AND DERIVATIVES IN CF_4 , SiF_4 , AND SF_6 FROM INFRARED INTENSITIES. P. N. Schatz and D. F. Hornig. *J. Chem. Phys.* 21, 1516-30(1953) Sept.

The absolute intensities of the fundamental infrared absorption bands of SiF_4 , CF_4 , and SF_6 were measured utilizing the pressure broadening technique. The effective bond moments, μ_0 and bond moment derivatives, $\partial\mu/\partial r$, are calculated as a function of the most general potential constants. Based on a valence-force field plus repulsion between nonbonded atoms, the most probable values (first column) and the alternatives (second column)

SiF_4	$\mu_0 = 2.3 \text{ d}$	3.3 d
	$\partial\mu/\partial r = -7.49 \text{ d/A}$	3.66 d/A
CF_4	$\mu_0 = 1.12 \text{ d}$	2.36 d
	$\partial\mu/\partial r = 4.88 \text{ d/A}$	3.35 d/A
SF_6	$\mu_0 = 2.65 \text{ d}$	0.65 d
	$\partial\mu/\partial r = 3.85 \text{ d/A}$	-6.58 d/A

The results are discussed. (auth)

152

VIBRATIONAL SPECTRA OF FLUORINATED AROMATICS.

III. 1,4-DIFLUOROBENZENE. E. E. Ferguson, R. L. Hudson, J. Rud Nielsen, and D. C. Smith. *J. Chem. Phys.* 21, 1457-63(1953) Sept.

The infrared absorption spectra of gaseous and liquid 1,4-difluorobenzene have been obtained in the regions 2 to 22 μ and 2 to 38 μ , respectively, with the aid of LiF, NaCl, KBr, and KRS-5 prisms. The Raman spectrum of the liquid phase has been photographed with a three-prism glass spectrograph of linear dispersion 15A/mm at 4358A. Depolarization ratios have been measured for the stronger Raman bands. A complete assignment of fundamental vibration frequencies has been made, and the spectra have been interpreted in detail. The nonplanar frequencies have been calculated with the aid of force constants determined for related molecules. (auth)

153

VIBRATIONAL SPECTRA OF FLUORINATED AROMATICS.

IV. 1,2,4,5-TETRAFLUOROBENZENE. E. E. Ferguson, R. L. Hudson, J. Rud Nielsen, and D. C. Smith. *J. Chem. Phys.* 21, 1464-9(1953) Sept.

The infrared absorption spectra of gaseous and liquid 1,2,4,5-tetrafluorobenzene have been obtained in the region 2 to 22 μ with the aid of LiF, NaCl, and KBr prisms. The Raman spectrum of the liquid phase has been photographed with a three-prism glass spectrograph of linear dispersion 15 A/mm at 4358A. Relative intensities and depolarization ratios have been measured for the stronger Raman bands. A complete assignment of fundamental vibration frequencies is made, and the spectra are interpreted in detail. The values of the nonplanar fundamental frequencies are checked by normal coordinate analysis. (auth)

154

VIBRATIONAL SPECTRA OF FLUORINATED AROMATICS.

V. 1,3-DIFLUOROBENZENE. E. E. Ferguson, R. L. Collins, J. Rud Nielsen, and D. C. Smith. *J. Chem. Phys.* 21, 1470-4(1953) Sept.

The infrared absorption spectrum of liquid 1,3-difluorobenzene has been obtained in the region 2 to 22 μ with the aid of LiF, NaCl, and KBr prisms. The contours of the strong infrared bands of the gaseous phase have also been observed in the region 5 to 22 μ . The Raman spectrum of the liquid has been photographed with a three-prism glass spectrograph of linear dispersion 15 A/mm at 4358A, and depolarization ratios have been measured for the stronger Raman bands. A complete assignment of fundamental vibra-

tion frequencies is given, and the spectra are interpreted in detail. (auth)

155

VIBRATIONAL SPECTRA OF FLUORINATED AROMATICS. VI. FLUOROBENZENE. D. C. Smith, E. E. Ferguson, R. L. Hudson, and J. Rud Nielsen. *J. Chem. Phys.* **21**, 1475-9(1953) Sept.

The infrared absorption spectra of gaseous and liquid fluorobenzene have been obtained in the regions 2 to 22 μ and 2 to 38 μ , respectively, with the aid of LiF, NaCl, KBr, and KRS-5 prisms. The Raman spectrum of the liquid phase has been photographed with a three-prism glass spectrograph of linear dispersion 15 A/mm at 4358A. A complete assignment of fundamental vibration frequencies is given, and the spectra are interpreted in detail. (auth)

156

VIBRATIONAL SPECTRA OF FLUORINATED AROMATICS. VII. 1,2,4-TRIFLUOROBENZENE. E. E. Ferguson, R. L. Hudson, J. Rud Nielsen, and D. C. Smith. *J. Chem. Phys.* **21**, 1727-30(1953) Oct.

The infrared absorption spectrum of liquid 1,2,4-trifluorobenzene has been obtained in the region 2 to 38 μ with the aid of LiF, NaCl, KBr, and KRS-5 prisms. The Raman spectrum of the liquid has been photographed with a three-prism glass spectrograph of linear dispersion 15A/mm at 4358A, and depolarization ratios have been measured for the stronger Raman bands. A complete assignment of fundamental vibration frequencies is given, and the spectra are interpreted in detail. (auth)

157

VIBRATIONAL SPECTRA OF FLUORINATED AROMATICS. VIII. 1,4-BIS(TRIFLUOROMETHYL)BENZENE. E. E. Ferguson, Louis Mikkelsen, J. Rud Nielsen, and D. C. Smith. *J. Chem. Phys.* **21**, 1731-5(1953) Oct.

The infrared absorption of liquid 1,4-bis(trifluoromethyl)-benzene has been obtained in the region 2 to 22 μ with the aid of LiF, NaCl, and KBr prisms. The Raman spectrum has been photographed with a three-prism glass spectrograph of linear dispersion 15A/mm at 4358A. A nearly complete assignment of fundamental vibration frequencies is given, and the spectra are interpreted in detail. (auth)

158

VIBRATIONAL SPECTRA OF FLUORINATED AROMATICS. IX. p-FLUOROTOLUENE. E. E. Ferguson, R. L. Hudson, J. Rud Nielsen, and D. C. Smith. *J. Chem. Phys.* **21**, 1736-40(1953) Oct.

The infrared absorption spectrum of liquid p-fluorotoluene has been obtained in the region 2 to 38 μ with the aid of LiF, NaCl, KBr, and KRS-5 prisms. The stronger bands of the gas phase have been scanned with NaCl and KBr prisms. The Raman spectrum of the liquid has been photographed with a three-prism glass spectrograph of linear dispersion 15A/mm at 4358A. A complete assignment of fundamental vibration frequencies is given, and the spectra are interpreted in detail. (auth)

159

A STUDY OF SOME FLUORINE-CONTAINING β -DIKETONES. J. D. Park, H. A. Brown, and J. R. Lacher. *J. Am. Chem. Soc.* **75**, 4753-6(1953) Oct. 5.

The preparation of seven new β -diketones containing fluorinated groups is reported. The infrared spectra and enolic content of these β -diketones were determined and are noted. Acetylacetone and 1,1,1-trifluoro-2,4-pentanedione were chlorinated and the products identified. (auth)

160

HEAT CAPACITY OF GASEOUS PERFLUOROCYCLOBUTANE. Joseph F. Masl. *J. Am. Chem. Soc.* **75**, 5082-4 (1953) Oct. 20.

The heat capacity of gaseous perfluorocyclobutane has

been measured with an accuracy of 0.1% with a constant-flow calorimeter at three pressures at each of the temperatures 10, 50, and 90°. Values of C_p^0 , believed reliable to 0.15%, were obtained by extrapolation of the measurements to zero pressure. These are 36.19, 39.23, and 42.01 cal/mole, respectively, at the three temperatures. The corresponding values of the pressure coefficient of heat capacity are 0.84, 0.47, and 0.28 cal/mole atm. (auth)

GRAPHITE

161

Alfred Univ. GRAPHITIZATION OF CARBON. TECHNICAL PROGRESS REPORT. V. D. Frechette and Yung Tao. Sept. 30, 1953. 9p. Contract AT(30-1)-1297. (NYO-3763)

An investigation of the improvement of the structure of graphite blocks with special attention to their bulk density was devoted to the study of surface oxidation to graphitic acid. A graph showing the bulk density at various pressures is given. (For preceding report in series see NYO-3762.) (J.E.D.)

162

THE LATTICE VIBRATION SPECIFIC HEAT OF GRAPHITE. J. Krumhansl and H. Brooks. *J. Chem. Phys.* **21**, 1663-9(1953) Oct.

Recent experiments have shown that the specific heat of graphite varies as T^2 instead of T^3 between 15 and 80°K. In this paper such a behavior is shown to be a consequence of the elastic anisotropy of graphite, and therefore an intrinsic property, rather than a particle-size effect as suggested by Gurney, or a plate-like behavior by Komatsu and Nagamiya. The Gurney treatment is shown to be in error, both as to the enumeration of modes and as to the temperature range over which the particle-size effect might be of significance. The Komatsu and Nagamiya treatment is shown to be inconsistent with elasticity theory. The present treatment employs a semirigorous analysis of the normal mode problem for the transverse vibrations, approximated for long wavelengths. It is found that experimental data from 15 to 1000°K can be well fitted by dividing the lattice vibrations into two types: modes with atom displacements normal to the layer planes with a Debye temperature of 900°K and modes with atom displacements in the planes with a Debye temperature of 2500°K. (auth)

163

THE SPECIFIC HEAT OF GRAPHITE FROM 13 to 300°K. W. DeSorbo and W. W. Tyler. *J. Chem. Phys.* **21**, 1660-3(1953) Oct.

The specific heat of high-purity Acheson graphite prepared by the National Carbon Company has been measured from 13 to 300°K. In the region 13 to 54°K the C_p data follows a T^2 dependence quite accurately in agreement with previous experimental work and recent theoretical investigations of specific heat in strongly anisotropic solids. On the basis of some recent studies for other highly anisotropic solids, it is suggested that the specific heat of graphite will eventually follow a T^3 dependence at still lower temperatures. The derived thermodynamic functions, entropy, enthalpy, and free energy, have been determined by graphical integration and tabulated at integral values of temperature up to 300°K. The entropy of graphite at 298.16°K is 1.372 ± 0.005 cal/g-atom deg, of which 0.004 is extrapolated from 13 to 0°K assuming the third law and the T^2 dependence. (auth)

LABORATORIES AND EQUIPMENT

164

Hanford Works FACILITIES FOR DECONTAMINATION OF LABORATORY

EQUIPMENT. O. L. Olson and J. F. Gifford. June 30, 1953. 20p. Contract W-31-109-Eng-52. (HW-26502)

An inexpensive, versatile decontamination chamber has been constructed for cleaning laboratory equipment. It has been used successfully for manual disassembly and cleaning of equipment showing radiation levels as high as 5 r/hr. A sandblasting cabinet was also constructed for decontamination of laboratory equipment. Trial runs showed that sandblasting would often reduce radiation levels as much as 99% on equipment which had been previously subjected to chemical decontamination without success. (auth)

165

Ames Lab.

EVALUATION OF A SHORT COLUMN WATER ELUTRIATOR. D. R. Wilder and E. S. Fitzsimmons. Oct. 15, 1953. 24p. Contract W-7405-eng-82. (ISC-414)

The construction of a short-column water elutriator is described, and its performance is evaluated. Possible sources of error are considered as well as the actual results of operation. Microscopic measurements are employed for evaluation of the fractions produced. Fractionation by decanting and the hydrometer method of particle-size-distribution measurement are also considered briefly. (auth)

RADIATION CHEMISTRY

166

ON THE CHEMICAL ACTIONS OF PENETRATING γ RAYS OF RADIUM 7. A. Kailan. Translated from *Monatsh. Chem.* 34, 1269-89(1913). 14p. (AERE-Trans-11/3/5/379)

The following effects of the penetrating γ rays of Ra were observed: The optical rotary power of a normal aqueous solution of grape sugar was changed 5 to 10° in the course of 2850 hr. Absolute ethyl alcohol was oxidized to aldehyde and acid, and water was formed. There was a very slight diminution of the acidity of succinic or malonic acid solutions. About one thousandth of a 0.25N solution of AgNO_3 , containing about 5 g of the salt, was reduced to Ag in about 4000 hr when kept in the dark. (C.H.)

167

HOT ATOM RECOILS FROM $\text{C}^{12}(\gamma, n)\text{C}^{11}$. Frank S. Rowland and W. F. Libby. *J. Chem. Phys.* 21, 1493-4(1953) Sept.

Simple C systems have been irradiated with the Univ. of Chicago betatron, producing C^{11} atoms by the reaction $\text{C}^{12}(\gamma, n)\text{C}^{11}$. The distribution of the radioactive atoms between CO and CO_2 for samples irradiated in the liquid phase was found to be 95 to 100% CO, and for samples irradiated in the solid phase about 50% of each oxide. A mechanism for these results is proposed. (auth)

168

HOT ATOM CHEMISTRY OF THE ALKYL BROMIDES; ABSENCE OF EFFECTS DUE TO HIGH RADIATION DENSITY: ISOTOPE SEPARATION IN SOLIDS. Frank S. Rowland and W. F. Libby. *J. Chem. Phys.* 21, 1495-9(1953) Sept.

A 30-C Po-Be neutron source which gives less than 0.1 r/hr in close contact was used to study the hot-atom chemistry of a selection of alkyl bromides. Comparison of the results with those obtained with ordinary neutron sources containing γ rays in abundance up to 700 r/hr equivalent strongly indicates that the essential phenomena reported are free of effects due to the γ -radiation density. The separation of the Br isotopes in crystalline alkyl bromides has been observed in several additional cases. No isotope effect is shown with CBr_4 , however, nor with frozen glasses. The possible theoretical significance of these results is discussed. (auth)

RADIATION EFFECTS

169

Yale Univ.

EFFECT OF GAMMA RADIATION ON HYDROCARBON GASES. PROGRESS REPORT NO. 5. June 30, 1953. 14p. Contract AT(30-1)-1173. (NYO-3312)

The effect of temperature on the radiation-initiated polymerization of pure C_2H_2 in the range 80 to 450°F was investigated in a pyrex glass reaction vessel with a surface-volume ratio of about 1.80 cm^{-1} . The rate data obtained were derived from total-pressure measurements made on a batch system of C_2H_2 . The polymerization rate was found to be independent of temperature in the range 80 to 250°F. Above 250°F there was an increase in the polymerization rate accompanying an increase in temperature. On the assumption that the polymerization rate is the additive result of two mechanisms, one of which is predominant below 250°F, the temperature-dependent mechanism that is observable only at temperatures above 250°F is found to correspond to an activation energy of 11.3 kcal/g mole. The effect of thermal polymerization of C_2H_2 in the absence of a radiation field was investigated in the range 440 to 650°F. An activation energy of 50 kcal/g mole was obtained. Pure thermal polymerization is insignificant below 450°F. Results are also given from preliminary investigations of the effects of pressure and inert gases, and of the reproducibility of results of the radiation-initiated polymerization of C_2H_2 . (For preceding period see NYO-3311.) (auth)

170

STUDIES OF BOND RUPTURE IN THE DECAY OF RaD AS TETRAMETHYL LEAD. R. R. Edwards, J. M. Day, and R. F. Overman. *J. Chem. Phys.* 21, 1555-8(1953) Sept.

Studies of bond rupture in $\text{Pb}(\text{CH}_3)_4$ caused by the β decay of $\text{Pb}^{210}(\text{RaD})$ have been made in solution and in vapor phase. The apparent bond rupture did not show the simple concentration dependence predicted for condensed systems by the cage hypothesis. Vapor-phase results were consistent with those from solution in indicating failure of bond rupture in the primary β and internal conversion processes. Indications are that bond rupture results from secondary processes involving neighboring atoms following the decay process. (auth)

171

SELF-RADIOLYSIS OF C^{14} -COMPOUNDS. Charles D. Wagner and Vincent P. Guinn. *J. Am. Chem. Soc.* 75, 4861(1953) Oct. 5.

It was observed that a sample of methyl- C^{14} iodide, 0.12 mc/millimole, sealed in vacuo and maintained at room temperature in the absence of light became wine red in color because of liberated iodine, whereas samples of methyl- C^{13} iodide treated similarly were colorless. It was estimated by spectrophotometric comparison with solutions of iodine in methyl iodide of known concentration that 0.135% of the methyl- C^{14} iodide had decomposed to give elemental iodine. It is suggested that those concerned with the problem of long-term storage of isotopic compounds of high specific activity consider as a means of meeting this problem the storage of such compounds in appropriate dilute solutions, from which they may be recovered for use. (J.E.D.)

SEPARATION PROCEDURES

172

Oak Ridge National Lab.

VAPOR-LIQUID EQUILIBRIUM IN WATER-NITRIC ACID SYSTEMS AT 760 mm Hg. F. P. Pike. June 20, 1950. 10p. (CF-50-6-143)

173

Oak Ridge National Lab.

A CONTINUOUS COUNTERCURRENT ION EXCHANGE

COLUMN WITH HIGH PRODUCTION CAPACITY DUE TO FREEDOM FROM FLUIDIZATION. S. H. Jury. Jan. 19, 1953. 6p. (CF-53-1-213)

The limitation of fluidizing velocity in the continuous operation of countercurrent ion exchange has been removed. If the flow streams are arranged so that the total pressure drop over the tower is 0, then fluidization will not occur. Diagrams are given which show the modifications made to the column to take advantage of the elimination of fluidizing velocity. (J.S.R.)

174

Bureau of Mines. Fuel Technology Div., Laramie, Wyo. RETORTING CHATTANOOGA, TENNESSEE OIL SHALE ENTRAINED-SOLIDS RETORT RUN 24-1235°F. Aug. 1953. 24p. Contract AT(49-1)-534. (OSRD-66)

The results of the first of a series of experimental runs in the entrained-solids retort to evaluate Chattanooga oil shale as a source of petrochemical raw materials are presented. In the work efforts to minimize loss of U were secondary to determining yields of petrochemicals, particularly low-molecular weight aromatic hydrocarbons, ethylene, and other gaseous products. Spent shale from all runs was to be shipped to Columbia Univ. for use in the U-recovery program. (J.E.D.)

175

THE SEPARATION OF BIOLOGICAL FATS FROM THEIR NATURAL MIXTURES BY THE USE OF ADSORPTION COLUMNS. SECOND REPORT. SEPARATION OF LIPID FRACTIONS DEVOID OF NITROGEN AND PHOSPHORUS. Wolfgang Trappe. Translated by Henry P. Kramer from *Biochem. Z.* 306, 316-36(1940). 32p. (UCRL-Trans-64; AEC-tr-1044)

176

THE SEPARATION OF BIOLOGICAL FATS FROM THEIR NATURAL MIXTURES BY MEANS OF ADSORPTION COLUMNS. FIRST REPORT. THE EULOTROPIC SERIES OF SOLVENTS. Wolfgang Trappe. Translated by Henry P. Kramer from *Biochem. Z.* 305, 150-61(1940). Sept. 1950. 15p. (UCRL-Trans-67; AEC-tr-1045)

177

TREATING URANIUM-BEARING SOLUTIONS WITH METALLIC IRON (Ob obrabotke uransoderznashchikh rastvorov metallicheskim zhelezom). I. Ya. Bashilov. Translated by G. Belkov from *Redkie Metal.* 2, 25-33(1934). 1952. 26p. (TT-311)

U, Cu, and V can be separated by treating solutions of their salts with metallic Fe. Cu is separated when the acidity is high, and U is separated at a much lower acidity. The U in the form of UO_2Cl_2 is reduced by Fe to UCl_4 . The UCl_4 hydrolyzes into $U(OH)_4$, and the latter dissociates into UO_2 . This process can be used on a plant scale if proper precautions are used. (J.S.R.)

178

THE HYDRODYNAMICS OF PACKED EXTRACTION COLUMNS. V. V. Kafarov and M. A. Planovskaya. Translated from *Zhur. Priklad. Khim.* 24, 624-33(1951). 10p. (AERE-Trans-11/3/5/361)

Experiments are described in which the hydrodynamics of packed extraction columns was studied in order to establish the limits of loading of the column with the continuous and disperse phases. Colored liquids were used for purpose of visual observation. Discussions are presented regarding the influences of the packing, the physical properties of the liquids, phase velocities and phase changes, and nozzle dimensions. The quantitative relationships of the influence of these various factors are summarized for several liquids. (L.M.T.)

SPECTROSCOPY

179

Spectroscopy Lab., Mass. Inst. of Tech.

THE VIBRATIONAL SPECTRA OF PYRIDINE AND PYRIDINE- d_5 . L. Corrsin, B. J. Fax, and R. C. Lord. [1952] 27p. (NP-4889; Technical Report 6)

Pyridine- d_5 has been prepared by exchange between pyridine vapor and heavy water in the presence of a Pd catalyst. Infrared and Raman spectra are reported for pyridine and pyridine- d_5 over the spectral range 300 to 4000 cm^{-1} . Interpretation of the spectra with the help of the product rule and by analogy with the fundamental frequencies of benzene and benzene- d_6 leads to complete sets of frequencies for the 27 vibrational degrees of freedom of pyridine and of pyridine- d_5 . The frequency assignment for pyridine does not differ greatly from previous ones, but is believed more reliable because of the additional spectroscopic data. (auth)

180

THE MICROWAVE SPECTRUM OF PHOSGENE. G. Wilse Robinson. *J. Chem. Phys.* 21, 1741-5(1953) Oct.

The microwave spectra of $C^{12}O^{16}Cl^{35}Cl^{35}$ and $C^{12}O^{16}Cl^{35}Cl^{37}$ have been investigated in the region 23,000 to 28,000 Mc/sec. The analyses of the rotational spectra yield for the phosgene molecule: C-O distance = $1.166 \pm 0.002\text{ \AA}$; C-Cl distance = $1.746 \pm 0.004\text{ \AA}$; and Cl-C-Cl angle = $111.3 \pm 0.1^\circ$. An analysis of the quadrupole hyperfine structure was made for both isotopic species, and the quadrupole coupling constants were obtained for $C^{12}O^{16}Cl^{35}Cl^{35}$. An attempt is made to explain the large observed value of the field dyadic asymmetry parameter η . (auth)

181

EFFECT OF SALT CONCENTRATION AND TEMPERATURE ON THE ULTRAVIOLET ABSORPTION SPECTRA OF AQUEOUS THIOSULFATE AND SULFITE. Donald P. Ames and John E. Willard. *J. Am. Chem. Soc.* 75, 3267-8 (1953) July 5.

The extinction coefficients of thiosulfate in the range of 250 to 270 m μ are decreased by increasing concentrations of Li, Na, K, and Mg, and they are increased by increased temperature. The ionic strength (in the range from 2 to 3) and the pH (in the range from 5 to 12) have no effect on the extinction coefficients. Na salt concentration and temperature have the same effect on sulfite as on thiosulfate. (J.S.R.)

SYNTHESES

182

Louisville Univ.

SULFOSTYRENES. PREPARATION AND POLYMERIZATION OF POTASSIUM p-VINYLBENZENSULFONATE. Richard H. Wiley, Newton R. Smith, and C. C. Ketterer. [1953] 19p. (AECU-2708)

p-Vinylbenzenesulfonic acid (sulfo styrene) has been prepared by dehydrohalogenation of β -bromoethylbenzenesulfonyl chloride, isolated as its toluidine and K salts, and characterized. The K salt has been polymerized to high viscosity polymers. The reduced viscosities (η_{sp}/c) for these polymers are non-linear functions of concentration (c) and show a marked increase as the concentration decreases. A previously developed relation ($\eta_{sp}/c = A/(1 + Bc) + D$) involving reciprocal reduced viscosity and concentration, but not square root of the concentration, gives a linear plot as does also a log-log plot of reduced viscosity and concentration. Both of these linear plots have finite intercepts roughly proportional to the specific viscosities of the polymers. The intercepts of the log-log plots are multiples of the D factors for these polysulfo styrenes and are, to the extent that the D factors are also, related to the intrinsic viscosity of the polymer. (auth)

183

Atomic Energy Project, Univ. of Rochester
STUDIES ON CARTILAGE. Eugene S. Boyd. Aug. 24,
1953. 110p. Contract W-7401-eng-49. (UR-245)

Results of a study of the relation between Ca and chondroitin sulfate in excised bone matrix and in excised demineralized cartilage indicate that chondroitin sulfate is responsible for the reaction of cations with cartilage. Factors regulating metabolism and the synthesis of chondroitin sulfate were investigated in samples of embryonic cartilage. The synthesis was shown to be stimulated by glucose and inhibited by respiratory inhibitors. The rate of formation of the final sulfonated molecule was shown to be dependent on the sulfate concentration, and to some extent on the age of the cartilage. (C.H.)

184

2-AMINO-RESORCINOL AND ITS DERIVATIVES. M. V. Likhoshesterov and V. E. Zhabotinskaya. Translated from *Zhur. Obshchei Khim.* **2**, 761-9(1932). 8p. (AERE-Trans-11/3/5/351)

185

EVOLUTION OF PHOTOSYNTHESIS IN LOWER ORGANISMS. (TO THE PROBLEM ON THE ORIGIN OF AUTOTROPHY). D. I. Sapozhnikov [Sapozhnikov]. Translated by S. Shewchuck from *Mikrobiologiya* **20**, Ed. 5, 438-51(1951). 26p. (UCRL-Trans-131)

The literature is reviewed covering various aspects of the evolution of plants from the heterotrophic anaerobiotics to the photosynthesizing aerobiotics. A scheme for energy production is presented which involves photoreduction, chemosynthesis, chemoreduction, and photosynthesis. Concepts of autotrophy and heterotrophy are discussed, and the characteristics of bacteria, algae, and other forms intermediate in the development of photosynthesizing plants are discussed. (C.H.)

186

THE PREPARATION OF NaC^{14}N and NaCN^{15} . Alan G. MacDiarmid and Norris F. Hall. *J. Am. Chem. Soc.* **75**, 4850-1(1953) Oct. 5.

A method of preparation of NaC^{14}N from $\text{BaC}^{14}\text{O}_3$ is outlined. Consistent yields of 70% or more were obtained in blank runs with inert BaCO_3 . NaCN^{15} was prepared from potassium phthalimide containing N^{15} . Yields of 97 to 100% were obtained. (J.E.D.)

TRACER APPLICATIONS

187

Lankenau Hospital Research Inst., Philadelphia
STUDIES OF THE INCORPORATION OF PALMITATE-1- C^{14} INTO TISSUE LIPIDES IN VITRO. Lillian A. Jedeikin and Sidney Weinhouse, Lankenau Hospital Research Inst., Philadelphia; Institute for Cancer Research, Philadelphia; and Temple Univ. [1953] 27p. Contract AT(30-1)777 (AECU-2736)

Palmitate-1- C^{14} was found to be incorporated into lipides of rat tissues in vitro. In experiments with liver slices and homogenates incorporation into phospholipides and non-phospholipides was significantly higher in tissue from fed than from fasted animals. A dependency on respiratory activity for incorporation into phospholipides was indicated by a higher incorporation with O_2 than with N_2 in the gas phase and by inhibiting effects of respiration inhibitors. Similar effects were not observed for incorporation of palmitate into non-phospholipides. Coenzyme A was found to stimulate incorporation of palmitate into phospholipides added as an aqueous emulsion to extracts of pigeon liver acetone powder. These results are regarded as indicating that the fatty acid ester bonds of phosphatides are formed

by stepwise transesterification between acyl coenzyme A and either glycerophorylcholine or glycerophosphate. A similar mechanism is probably not involved in the formation of the glyceride ester bond. (auth)

TRANSURANIC ELEMENTS AND COMPOUNDS

188

Los Alamos Scientific Lab.

THE CRYSTAL STRUCTURE OF KPuO_2CO_3 , $\text{NH}_4\text{PuO}_2\text{CO}_3$, $\text{RbAmO}_2\text{CO}_3$. F. H. Ellinger and W. H. Zachariassen. [1953] Decl. Nov. 2, 1953. 18p. (AECD-3599)

X-ray-diffraction data and chemical information are used to identify the compounds KPuO_2CO_3 , $\text{NH}_4\text{PuO}_2\text{CO}_3$, and $\text{RbAmO}_2\text{CO}_3$. These isostructural compounds are hexagonal with two stoichiometric molecules per unit cell. The unit cell dimensions are:

	a_1	a_2
KPuO_2CO_3	$5.09 \pm 0.01 \text{ \AA}$	$9.83 \pm 0.02 \text{ \AA}$
$\text{NH}_4\text{PuO}_2\text{CO}_3$	$5.09 \pm 0.01 \text{ \AA}$	$10.39 \pm 0.02 \text{ \AA}$
$\text{RbAmO}_2\text{CO}_3$	$5.12 \pm 0.01 \text{ \AA}$	$10.46 \pm 0.04 \text{ \AA}$

The space group is $\text{C}6/\text{mmc}$ (D_{6h}^{14}), and the atomic positions are: 2 R in (0,0,0) ($0,0,\frac{1}{2}$), 2 X in $\pm(\frac{1}{3},\frac{2}{3},\frac{1}{4})$, 2 C in $\pm(\frac{2}{3},\frac{1}{3},\frac{1}{4})$, 6 O_I in $\pm(x,2x,\frac{1}{4})$ ($2\bar{x},\bar{x},\frac{1}{4}$) ($x,\bar{x},\frac{1}{4}$), 4 O_{II} in $\pm(\frac{1}{3},\frac{2}{3},\frac{1}{4} \pm z)$. For the K compound, the parameter values are taken to be $x = 0.812$, $z = 0.197$. (auth)

TRITIUM AND TRITIUM COMPOUNDS

189

Atomic Energy Research Establishment, Harwell, Berks (England)

THE PREPARATION OF TRITIATED WATER. E. J. Wilson. July 1953. 6p. (AERE-1/M-28)

A safe method of producing small quantities of tritiated water by the catalytic oxidation of T_2 gas with Pd is described. (auth)

URANIUM AND URANIUM COMPOUNDS

190

Oak Ridge National Lab.

THE PRODUCTION OF URANIUM(VI) BY FERROUS IRON IN PHOSPHORIC ACID SOLUTION: THE FORMAL ELECTRODE POTENTIAL OF THE U(IV)/(VI) COUPLE. C. F. Baes, Jr. June 19, 1953. Decl. Oct. 20, 1953. 24p. (AECD-3594; ORNL-1581)

The extent of reduction of U(VI) by Fe(II) in phosphoric acid solution has been measured as a function of the phosphoric acid concentration (1.9 to 7.7M) and as a function of the Fe(II)/Fe(III) ratio. Kinetic measurements of the slow redox equilibrium involved conform to a first order rate law. The introduction of fluoride ion into these solutions considerably increases both the reaction rate and the extent of reduction. The formal electrode potential of the U(IV)/(VI) couple has been estimated in the range 1.85 to 4.8M H_3PO_4 . (auth)

191

Oak Ridge National Lab.

THE CHEMISTRY OF URANIUM(VI) ORTHOPHOSPHATE SOLUTIONS. PART 1. A SPECTROPHOTOMETRIC INVESTIGATION OF URANYL PHOSPHATE COMPLEX FORMATION IN PERCHLORIC ACID SOLUTION. C. F. Baes, Jr., J. M. Schreyer, and J. M. Lesser. June 22, 1953. Decl. Oct. 20, 1953. 24p. (AECD-3596; ORNL-1577)

Job's method of continuous variations has been applied to $\text{UO}_2(\text{ClO}_4)_2 \cdot \text{H}_2\text{PO}_4$ mixtures in 1M and in 0.1M HClO_4 . In both cases the data indicate the presence of complex species in which the ratio $\text{PO}_4^{3-}/\text{UO}_2^{2+}$ is unity. A formation constant, $K_1 = 38 \pm 12$, has been calculated from the data in 1M HClO_4 . (auth)

192

THE REACTION OF URANIUM WITH QUINALIZARIN AND ITS POSSIBLE APPLICATIONS TO THE COLORIMETRIC ANALYSIS OF SODIUM. F. Pino and J. Chabannes. Translated from *Anales edafol. y fisol. vegetal* (Madrid) 10, 595-602(1951). 10p. (AEC-tr-1679)

A blue solution results when U(VI) reacts with quinalizarin in a neutral medium. In this paper the authors study the conditions which, according to Beer's law, would permit a colorimetric determination of U and, indirectly, of Na. (auth)

193

DIMORPHISM OF THE SULFIDE OF URANIUM US_2 . Marius Picon and Jean Flahaut. *Compt. rend.* 237, 808-10(1953) Oct. 12. (In French)

Uranium sulfide US_2 exists in two forms with different properties. The α form is stable at high temperatures, and the β form is stable at low temperatures. The point of transition is approximately 1350°. Crystals of US_2 β form in the presence of crystalline seed. Below the point of transformation both varieties of US_2 can be obtained. (J.S.R.)

ENGINEERING

194

Standard Oil Co. of Ind.
DEVELOPMENT AND EVALUATION OF HIGH-TEMPERATURE GREASES. Cecil G. Brannen and Edward A. Swakon. July 1953. 25p. (WADC-TR-53-83)

In the work directed toward the development of an aircraft grease suitable for use over a wide temperature range, emphasis has been placed on the development of thickeners for silicone oil and on the evaluation of silicone oil greases at high temperatures. Studies were made on 101 silicone oil greases containing as thickeners representatives of ten classes of materials that might be expected to produce thermally stable greases. Each composition was subjected to simple laboratory tests for preliminary evaluation, and 29 compositions were run in the ABEC-NLGI bearing tester. The greases containing inorganic thickeners showed poor performance in the bearing tester, all failing in less than 100 hr at 450°F. Several tests of 200 hr or more were obtained with Cu phthalocyanine, Ca acetate, and urea greases. One test of 650 hr was obtained with a grease containing *p*-carboxydiphenylurea as thickener. This test satisfies the high-temperature bearing-test requirement of the contract. (auth)

195

Southwest Research Inst.
POLYNUCLEAR AROMATIC COMPOUNDS FOR HIGH TEMPERATURE LUBRICANTS. FINAL REPORT FOR PERIOD FROM AUGUST 1, 1952 TO JULY 31, 1953. Charles F. Raley, Jr. Sept. 1953. 50p. Contract AF-33(616)-276. (WADC-TR-53-337; Technical Report 4)

A literature survey covering the field of polynuclear aromatic compounds with two or three nuclear rings was made. All materials liquid at 35°C and stable up to 400°F were entered on file cards. From the data thus gathered, a list of 17 compounds, considered to be representative of the common chemical structures, was compiled. These compounds were synthesized and evaluated as to thermal stability, viscosity at 100 and 210°F, density, and boiling point. On the basis of this evaluation, the field of aryl phosphates was considered to have the most likely chance of providing compounds with the desired properties.

Further research in this field has produced three liquid compounds with exceptional thermal stabilities, i.e., above 700°F; di-*p*-tolyl 1-naphthyl phosphate, di-*m*-tolyl 1-naphthyl phosphate, and tri-*o*-chlorophenyl phosphate. In the case of the first two compounds, all other screening tests, such as flash and fire point, autogenous ignition temperature, and hydrolytic stability, gave excellent results. Other compounds which will be synthesized offer a reasonable chance of possessing even better properties. (auth)

196

BIBLIOGRAPHIC OUTLINE ON THE AGENTS AND CAUSES OF THE CORROSION OF CONCRETE. PART 3. FIRE (HEAT). A. Nicol. Translated by Yvette DeFelice from *Rev. matériaux construction et trav. publ.*, ed. C, 71-4 (1950). 9p. (AEC-tr-1682)

The effects of fire on the cement, free lime, and aggregates of normal concrete and the factors determining its fire resistance are discussed. The preparation, mechanical resistance, and fire-resisting properties of refractory concretes are then discussed, and their uses and advantages are summarized. (L.M.T.)

HEAT TRANSFER AND FLUID FLOW

197

Delaware Univ.
HEAT TRANSFER TO LIQUID METALS. W. Francis Lindell and Edward C. Lawson, Jr. Apr. 1, 1952. 66p. Contract N8on4-74002. (ATI-166713; U22439; ME-T-2)

Investigation was made to determine free-convection heat-transfer coefficients between a horizontal heated tube and a bath of Bi-Pb eutectic alloy. The major problem was measuring the surface temperature of the heated tube. This was approached by a study of accurate surface-temperature determination by means of thermocouples inserted in long, fine holes parallel to the surface and by means of wire thermocouples inserted in carefully fitted shallow holes and peened in normal to the surface. Several sizes of thermocouple wires were used, and the surface temperature was obtained by extrapolating to zero wire diameter. Tests in air were quite satisfactory. (auth)

198

Bureau of Mines
THEORETICAL CONSIDERATION OF HEAT TRANSFER IN THE GAS-FLOW OIL-SHALE RETORT. C. J. Mains and Arthur Matzick. Aug. 1953. 22p. (BM-RI-4995)

The gas-flow oil-shale retort is a continuous, cross-flow, gas-to-broken solid heat-exchange system in which heat is transferred by convection from the gas to the solid. This type of heat transfer presents a problem of analysis that cannot be solved by methods in common use. Solution of this problem is necessary for design, operation analysis, and prediction wherever that type of heat exchanger is used. This report embodies a method for calculation of heat-transfer coefficient and temperature histories of gas and solid in the gas-flow retort operating at equilibrium conditions. Detailed calculations are presented to show the application of the method to conditions of an actual run made in the gas-flow retort. Although used here for a specific case, the method is applicable to all heat exchangers that are characterized by continuous, crossflow, gas-to-broken solid heat transfer. (auth)

199

Los Alamos Scientific Lab.
IS THERE A HELMHOLTZ MIXING COEFFICIENT? Richard L. Ingraham and John A. Wheeler. Sept. 15, 1953. 19p. Contract W-7405-eng-36. (LA-1593)

In the slip stream behind a Mach shock two layers of gas of the same material are set into sliding motion with

respect to each other under conditions where all initial turbulence can be eliminated. Photographs of such shocks reveal that an intermingling of the two layers takes place, which in the first approximation grows linearly with the amount of the displacement of the one layer with respect to the other. The present report attempts to determine a "wiping coefficient" which represents the ratio of the depth of the layer of mixing to the lateral displacement of the two layers with respect to each other. Contrary to expectation, no universal value for this "wiping coefficient" was found in the four cases for which data were available:

Gas	Shock Strength	Wiping Coefficient
CCl ₄	3.73	0.20
CCl ₄	8.21	0.36
CO ₂	1.68	~0
Air	4.06	0.11

For this reason it is concluded that many more such events must be analyzed before a satisfactory picture of the mixing processes can be formed. The methods of calculation applicable for this purpose are also contained in the text. (auth)

200

Massachusetts Inst. of Tech.

BOILING HEAT TRANSFER PROJECT. PROGRESS REPORT [FOR] JUNE AND JULY 1953. Joseph B. Walsh. 11p. Contract N5-ori-07827. (NP-4925)

The channel height in the visual test section was reduced from 0.500 to 0.180 in., and runs were made at 1000 psia. Data could not be analyzed as the bubble photographs were not clear enough. Data are presented from the crud program on one boiling and one nonboiling run at pressures of 2000 psia, velocities of 1 fps, and temperatures of 435°F. (For preceding period see NP-4713.) (L.M.T.)

201

Massachusetts Inst. of Tech.

BOILING HEAT TRANSFER PROJECT. PROGRESS REPORT [FOR] AUGUST AND SEPTEMBER 1953. Joseph B. Walsh and Milton W. Raymond. 6p. Contract N5-ori-07827. (NP-4926)

A successful illumination system has been developed for the 0.180-in. channel height. Effort is now being concentrated on breakage problems associated with the flash lamp and the channel-height windows. No data are reported for this period. (For preceding period see NP-4925.) (L.M.T.)

202

THE PROBLEM OF A SUBMERGED JET. Yu. B. Rumer. Translated by G. Belkov from *Priklad. Mat. i Mekhan.* 16, 255-6(1952). 7p. (TT-383)

The problem of a laminar submerged jet expelled from the end of a thin tube into unlimited space filled with the same liquid was considered by Landau (*Mekhanika sploshnykh sred.* §19, G.T.T.L. (1944)). He noted that, if the full discharge of liquid through a fixed area encompassing the end of the tube is calculated by the formulas obtained by him, the answer is zero. The present paper shows that the exact solution found by Landau (in an actual case it is equal to a nonzero discharge) is only of the first approximation, satisfactory for a description of the motion of liquids at large distances from the end of the tube. The second approximation is found which should be taken as the terminal discharge. (auth)

MATERIALS TESTING

203

British Intelligence Objectives Sub-Committee

ELECTRONIC PRINCIPLES AS APPLIED IN GERMANY TO THE TESTING OF MATERIALS. W. G. Shilling. [nd] 102p. (BIOS-FR-724; ATI-70306)

204

British Intelligence Objectives Sub-Committee

EDDY CURRENT INSTRUMENTS FOR THE USE IN THE FIELD OF NON-DESTRUCTIVE TESTING. (INTEROGATION OF DR. FRITZ FÖRSTER). E. G. Stanford and H. W. Taylor. [nd] 36p. (BIOS-FR-1791; ATI-63876; Interrogation Report 817)

RADIOGRAPHY

205

Los Alamos Scientific Lab.

APPLICATION OF CESIUM-137 TO INDUSTRIAL RADIOGRAPHY. James W. Dutli and Grover M. Taylor. Oct. 8, 1953. 20p. (AECU-2719)

The fission product isotope Cs¹³⁷ was investigated for use as a γ source for industrial radiography. This isotope has a half life of 37 yr, emits 1.2-Mev β particles in 5% of the disintegrations, and emits 0.52-Mev β particles followed by 0.66-Mev γ rays in 95% of the disintegrations. Technique curves and resolution determinations were made for 1.5 to 4.5 in. of Al and 0.25 to 2.5 in. of steel, and comparison data for Co⁶⁰ are given. The results with Cs¹³⁷ closely resemble those for Co⁶⁰. For purposes of comparison some objects were radiographed with 150-kvp, 260-kvp, and 1-Mev x rays and Co⁶⁰ and Cs¹³⁷ γ rays. A comparison with Co⁶⁰ was made regarding specific activity, half life, and personnel protection. It was concluded that Cs¹³⁷ is a suitable radiographic source comparable with Co⁶⁰. (auth)

206

High Voltage Research Lab., Mass. Inst. of Tech.

RADIOGRAPHIC PROPERTIES OF X-RAYS IN THE 2 TO 6 MILLION VOLT RANGE. John G. Trump. Aug. 21, 1953. 51p. (NP-4759)

Experimental determination of the transmission curves in steel was made for thick-target x rays from homogeneous electrons accelerated by tube potentials of 2, 3, 5, and 6 megavolts. Measurements were made for the total radiation and also, with the exception of the 5-megavolt potential, for the direct beam. The factors governing radiographic exposure time and sensitivity were calculated and are listed in tabular form. For each voltage comparison is made between the experimental value of the total radiation absorption coefficient and the calculated value for γ rays having an energy equal to the maximum in the continuous beam. A representative exposure chart and curves of the latitude and of the sensitivity obtainable for flat steel plates with Eastman Type A industrial x-ray film were drawn. It was concluded that increasing operating voltages from 2 to 6 megavolts will give a greater latitude and a small improvement in sensitivity in addition to the expected large increase in speed and in the maximum thickness which can be radiographed. It appears that there would be no significant improvement in sensitivity for tube potentials beyond 4 or 5 megavolts. A description of the proposed design of a 4-megavolt x-ray generator is included. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

207

Illinois Univ.

REFRACTORY BODIES COMPOSED OF BORON AND TITANIUM CARBIDES BONDED WITH METALS. D. G. Bennett, J. A. Nelson, T. A. Willmore, and R. C.

Womeldorph. Apr. 1951. 25p. (AF-TR-6540; ATI-115768)

CORROSION

208

Research Foundation, Ohio State Univ.

MATERIALS FOR HANDLING FUMING NITRIC ACID.

Frank H. Beck, M. L. Holzworth, and Mars G. Fontana. Mar. 1952. 33p. (AF-TR-6519(pt.1); ATI-159418)

Welded drums of type 347 stainless steel fail by knife-line attack if the heat-affected zone (destabilized zone) is subjected to a sensitizing treatment (900 to 1500°F) after welding. Failure by knife-line attack occurs because the NbC in a narrow zone adjacent to the weld goes into solution and remains in solution on subsequent cooling (this effect is called destabilization). Sensitizing treatments cause the precipitation of Cr carbide in the grain boundaries (as is observed in Type 304 stainless steel), and intergranular corrosion results. Failure by knife-line attack has not been observed in extralow-carbon type 347 stainless steel. Type 347 stainless steel is not susceptible to stress corrosion by fuming HNO_3 at 160°F. The high corrosion rates which occur on Type 347 stainless steel in fuming HNO_3 at 160°F can be reduced from 100 to 200 mils/year to approximately 13 mils/year by the addition of $\text{Al}(\text{NO}_3)_3$ or Al metal to the acid solution in concentrations of approximately 0.1% Al or higher. Ti, Haynes alloy 25 (L-605), and Zr show excellent resistance to fuming HNO_3 in the temperature range room temperature to 160°F. Al and some of its alloys, show better corrosion resistance than the stainless steels at 160°F. (auth)

209

Argonne National Lab.

EFFECTS OF GALLIUM ON MATERIALS AT ELEVATED TEMPERATURES. W. D. Wilkinson. Issued Aug. 1953. 67p. Contract W-31-109-eng-38. (ANL-5027)

An investigation of the relative tendencies of various metals and refractories to react with Ga at selected temperatures in the range of 100 to 1000°C or higher, and, in some cases, attempts to inhibit such reactions are reported. Tungsten was found to be the only metallic element completely unattacked by Ga at temperatures up to 800°C, and Re was also practically unaffected by Ga at that temperature. Beryllium was next in resistance to attack by Ga being substantially unaffected by it at temperatures up to 500°C, while Ta and Nb were likewise unaffected at temperatures up to 450°C, although Nb was attacked more severely than Ta at higher temperatures. TaW, a tantalum-tungsten alloy, was not quite as resistant to Ga as was Ta, but was more resistant than are other binary alloys that were tested. No other metals were found as resistant to attack by Ga at temperatures of these magnitudes. Stainless steel appears promising, for use with Ga at temperatures up to 200°C whereas Cu and Pt are not. The nonmetallics were investigated with the idea both of looking into the possibility of developing nonmetallic coatings—perhaps of a self-healing nature—that could protect structural materials against attack by Ga and of determining the resistance of ceramic materials to attack by Ga at temperatures up to, in some cases, 1000°C or higher. A few data on the liquidus temperatures of several low-melting Ga alloys are also presented. (auth)

210

Engineering Research Inst., Univ. of Mich.

AN INVESTIGATION OF INTERGRANULAR OXIDATION IN STAINLESS STEEL. QUARTERLY PROGRESS REPORT NO. 3. C. A. Siebert, M. J. Sinnott, and R. E. Keith. Sept. 1953. 39p. Contract AF 33(616)-353. (NP-4934, Quarterly Progress Report No. 3)

The determination of the effect of temperature between 1600 and 2000°F on intergranular oxidation or corrosion in stainless steel and an examination of the effects of alloy composition are reported. Determination of the nature of the penetrating material in areas of intergranular attack and methods of reducing or eliminating intergranular penetration were studied. (J.E.D.)

211

Royal Aircraft Establishment, Farnborough, Hants (England)

ELECTROCHEMICAL MEASUREMENTS ON CLAD ALUMINUM ALLOYS. H. C. Cocks. Apr. 1951. 11p. (RAE-TN-MET-143; ATI-107227)

212

THE CORROSION PROTECTION OF THE COOLING UNITS OF INTERNAL COMBUSTION ENGINES. W. O. Kroenig and S. E. Pawlow. Translated by Margaret Schloo from *Metall Schutz* 9, 268-73(1933). 10p. (AEC-tr-1697).

Results are presented from a study in which $\text{K}_2\text{Cr}_2\text{O}_7$ was used to form protective films on metals to prevent corrosion by H_2O . (L.M.T.)

GEOLOGY AND MINERALOGY

213

Columbia Univ.

INTERPRETATION AND VALUATION OF URANIUM OCCURRENCES IN THE BIRD SPRING AND ADJACENT MINING DISTRICTS, NEVADA. PROGRESS REPORT. Charles H. Behre, Jr. and Paul B. Barton, Jr. Aug. 31, 1953. (RME-3057; CU-1-53-AT-1550-Geol.)

Uranium mineralization in the Bird Spring and Spring Mountain Ranges, Nev., is regionally and structurally of three types: (1) along fractures in a definite sandy horizon in the Permian Kaibab formation on the eastern slope of both ranges; (2) in fractures and cement of Tertiary lavas, tuffs, and gravels and the immediately underlying Paleozoic rocks in the lowland east and south of the Bird Spring Range and perhaps in the volcanic rocks near the crest of the Spring Mountain Range; and (3) in the oxidized parts of cupriferous and ferruginous fissure veins and replacements. None of these occurrences promises economical importance, but study of their relations continues in search for factors governing depositional principles to aid in prospecting. Progress in geologic mapping of the region is reported briefly. (auth)

214

Iowa State Coll.

PROGRESS REPORT [FOR] MARCH 1, 1953 TO AUGUST 31, 1953. M. R. Mickey. Sept. 23, 1953. 5p. (RME-3059)

The problem of the design of drilling patterns for U exploration in the Colorado Plateau and the possibility of meeting the AEC drilling program objectives by means of confining the bulk of the drilling to "sample" areas within drilling areas are presented briefly. (J.E.D.)

215

Pennsylvania State Coll. School of Mineral Industries AN INVESTIGATION OF THE MINERALOGY OF URANIUM-BEARING DEPOSITS IN THE BOULDER BATHOLITH, MONTANA. PROGRESS REPORT [FOR] APRIL 1-SEPTEMBER 30, 1953. H. D. Wright, B. H. Bieler, and W. P. Shulhof. Issued Oct. 1, 1953. 15p. Contract AT(30-1)-1390. (RME-3061; Progress Report 4)

Laboratory studies of Boulder batholith U deposits included preliminary study and identification of W. Wilson secondary U minerals, preparation of wall rock samples for chemical and spectroscopic analysis, and measurement of the lattice constant of a pitchblende sample from the W. Wilson deposit. Optical, x-ray, and spectrographic data were obtained on six secondary U mineral specimens;

metatorbernite was identified, and several tentative identifications were made. Chemical changes accompanying wall rock alteration at the W. Wilson deposit, based on analysis of one sample section, included a decrease in alumina, total Fe, lime, soda, and potash, and an increase only in silica. Little change in magnesia, CO_2 , S, Ti, and P was indicated. The lattice constant of a pitchblende sample from the W. Wilson deposit was found to be 5.39 Å. Field studies involved mapping and sampling, chiefly in the W. Wilson, G. Washington, and Free Enterprise siliceous reef deposits and the Lone Eagle base metal deposit. In the siliceous reefs, vein silica color types and radioactivity were mapped, and a map of wall rock alteration zones in the W. Wilson was prepared. Emphasis in the sampling program was placed on systematic collection of secondary U minerals and collection of a more complete assemblage of vein material representing the wide variety of silica color types. Recent development work in the Lone Eagle mine afforded the first opportunity for extensive study of a base metal U deposit. Vein silica color types and radioactivity were mapped, and samples were collected for studies of wall rock alteration and vein mineralogy. (For preceding report in series see RME-3041.) (auth)

216

Minnesota Univ.

URANIUM OCCURRENCE IN ASPHALTITES. TECHNICAL REPORT [FOR] MARCH 31, 1953 TO OCTOBER 1, 1953.

Thomas D. O'Brien. Oct. 1, 1953. 9p. (RME-3062)

The object of this work was to try to establish the form in which U occurs in the Colorado Plateau asphaltites. A radioactive yellow sublimate obtained by heating an asphaltic type ore from Calf Mesa in Emery Co., Utah, was shown to be arsenic sulfide. Chemical properties of the radioactive substance indicated Po, but the decay curve indicates a half life of 53 days, while the reported half life of Po is 140 days. Rather complete differential analysis shows that there is practically no hydrocarbon material in this asphaltite, and that practically all of the C is in the uncombined form. Solvent extraction also indicates the absence of organic material, because in no case was more than a few drops of organic material obtained from 25-g samples. (For preceding period see RME-3040.) (auth)

217

Columbia Univ.

PROGRESS REPORT: OCTOBER 1953. Paul F. Kerr. Issued Oct. 1953. 7p. Contract AT-30-1-702. (RME-3064)

Preparation of a geological map of the Marysvale area, preparation of an alteration map of the Marysvale area, the study of U in the older sediments of the Tushar Range, and the evaluation of the significance of the Marysvale occurrence with respect to the Colorado Plateau are discussed briefly. The laboratory work covered the study of the crystallite dimensions and lattice disorder in uraninite as well as studies of specific occurrences from the standpoint of association and origin. The data on Marysvale are also being coordinated with laboratory investigation. (auth)

218

Division of Raw Materials, AEC

BIBLIOGRAPHY AND INDEX OF LITERATURE ON URANIUM AND THORIUM AND RADIOACTIVE OCCURRENCES IN THE UNITED STATES. PART 3. COLORADO AND UTAH. Margaret Cooper. Issued Aug. 1953. 311p. (RME-4003)

A bibliography consisting of references to published literature, press releases, speeches, and both open-file and other unclassified reports dealing with U, Th, and radioactive occurrences in Colo. and Utah is presented. It is Part 3 of a comprehensive bibliography planned to cover references to all similar deposits throughout the

world. Although the object has been to make the present bibliography as all-inclusive as possible, from the point of view of including all the major papers and at least one reference to each known radioactive occurrence in these two states, only references for which the original text was readily available for examination and checking have been cited at this time. The remaining old and new references will be added to this basic list when the section is ready for inclusion in the comprehensive volumes, planned for future publication as a complete bibliography of the entire United States and world. (auth)

219

Geological Survey

EXTRACTION OF URANIUM FROM AQUEOUS SOLUTION BY COAL AND OTHER MATERIALS. George W. Moore. June 1953. 16p. (TEI-235)

Since U in nature is commonly associated with carbonaceous material, laboratory studies were conducted to determine the relative ability of various types of carbonaceous material and some other substances to remove U from solution. The results of these experiments indicate that the low rank coals are more effective in extracting U than any of the other materials used. A chemical determination shows that nearly 100% of the available U in solution is removed by subbituminous coal. The U is apparently retained in the coal by an irreversible process. The notable affinity of U for coalified plant remains suggests that some U deposits may have been formed over a long period of time by the extraction of U from dilute ground-water solutions. A possible application of the results of this work may be the extraction of U by coal from natural water or from waste solutions from U processing plants. (auth)

220

Geological Survey

URANIUM-BEARING COPPER DEPOSITS IN THE COYOTE DISTRICT, MORA COUNTY, NEW MEXICO. Howard D. Zeller and Elmer H. Baltz, Jr. May 1953. 40p., 1 illus. (TEI-338)

Uranium-bearing Cu deposits occur in steeply dipping beds of the Sangre de Cristo formation of Pennsylvanian and Permian age south of Coyote, Mora County, N. Mex. Mapping and sampling of these deposits indicate that they occur in lenticular carbonaceous zones in shales and arkosic sandstones. Samples from these zones contain as much as 0.067% U and average 3% Cu. Metatuyamunite is disseminated in some of the arkosic sandstone beds, and uraninite was identified in some of the Cu sulfide nodules occurring in the shale. In polished section these sulfide nodules were found to be composed principally of chalcocite with some bornite and covellite, as well as pyrite and malachite. Most of the samples were collected near the surface from the weathered zone. The Cu and U were probably deposited with the sediments and concentrated into zones during compaction and lithification. Carbonaceous material in the Sangre de Cristo formation provided the environment that precipitated U and Cu from mineral-charged connate waters forced from the clayey sediments. (auth)

221

ON METAMICTIC DISINTEGRATION OF THE ZIRCON GROUP OF MINERALS. E. E. Kostyleva. Translated by Taisia Stadnichenko from p. 27-35 of *Voprosy mineralogii geokhimii i petrografii*, Akademii Nauk S.S.S.R., Moscow (1946). 16p. (TEI-369)

222

WHAT THE URANIUM PROSPECTOR SHOULD KNOW ABOUT RADIATION. Robert J. Wright. *Eng. Mining J.* 154, 92-5(1953) Jan.

The problem of radioactivity and its detection and meas-

urement as related to the prospector of U ores is discussed. The types of radiation, the U series, the geologic effects of weathering on U ores, and the prospecting counters are described. (This appeared as RMO-820 under the title "Radioactivity and Uranium Ores."). (J.S.R.)

223

URANIUM-MINING OPERATIONS OF THE UTEX EXPLORATION COMPANY IN THE BIG INDIAN DISTRICT, SAN JUAN COUNTY, UTAH. Charles A. Steen, George P. Dix, Jr., Scott W. Hazen, Jr., and Russell R. McLellan. Bureau of Mines Information Circular No. 7669, Oct. 1953. 23p.

The history and descriptions of the location, physical features, development, and geology of the Utex mine are presented. Mining methods, the mine plant, and ore production since 1952 are discussed. (J.E.D.)

METALS AND METALLURGY

224

Los Alamos Scientific Lab.
A PRELIMINARY INVESTIGATION ON THE RADIOGRAPHIC VISUALIZATION OF CRACKS. James W. Dutli and Gerold H. Tenney. Oct. 14, 1953. 16p. (AECU-2722)

Design of a tool is described by which one can experimentally determine practical limitations of the radiography of cracks. Variables considered include width, depth, and angular orientation. Experimental results for a total thickness of 3 in. of steel are given, using crack depths of $\frac{1}{8}$ in., $\frac{1}{4}$ in., $\frac{1}{2}$ in., crack widths from 0 to 0.006 in., and angles from 0 to 20°. Experimental threshold data were obtained for 0° angle using coarse, medium, and fine grain films. The angle experiments were confined to medium grain film only. (auth)

225

Atomic Energy Research Establishment, Harwell, Berks (England)
ARGON ARC WELDING OF ALUMINIUM. (REVISED VERSION OF AERE-EL/M-28). F. Wade. Sept. 1949. 8p. (AERE-EL/M-49)

226

Allegheny Ludlum Steel Corp.
THE DEVELOPMENT OF SHEET MATERIALS FOR HIGH TEMPERATURE APPLICATIONS. Joseph B. Meierdirks and Gunther Mohling. Nov. 4, 1948. 37p. (AF-TR-5731; ATI-40774)

227

Argonne National Lab.
RESISTIVITY OF NaK. P. G. Drugas, I. R. Rehn, and W. D. Wilkinson. Issued Oct. 2, 1953. 11p. Contract W-31-109-eng-38. (ANL-5115)

Resistivity measurements of two liquid NaK alloys containing 44.8 and 80% K by weight were made. The method consisted of passing a measured current through a calibrated Inconel tube containing NaK alloys, heating the central portion to a uniform temperature over a length of 12 in., and measuring the potential drop across the heated length. The measurements were made over a temperature range of 30 to 720°C. The resistivity curve for the 44.8-wt. % K alloys appeared to consist of two straight lines with a break at 220°C. The curve for the 80-wt. % alloy was uniformly curved. (J.S.R.)

228

Ohio State Univ.
A STUDY OF THE RELATIONS BETWEEN MICRO AND GROSS SOLUTION POTENTIALS AND SUSCEPTIBILITY TO INTERGRANULAR CORROSION OF A 24S ALUMINUM ALLOY AND SOME AUSTENITIC STAINLESS STEELS (thesis). Lee R. Standifer, Jr. 1952. 185p. (ATI-150115)

229

Engineering Research Inst., Univ. of Mich.
DEVELOPMENT OF PROCEDURES FOR THE IDENTIFICATION OF MINOR PHASES IN HEAT-RESISTANT ALLOYS BY ELECTRON DIFFRACTION. QUARTERLY PROGRESS REPORT [FOR] PERIOD JANUARY 15 TO APRIL 15, 1952. L. O. Brockway and W. C. Bigelow. Apr. 15, 1952. 20p. (ATI-151419; Quarterly Progress Report 1)

The adaptation of electron-diffraction methods to the identification of minor constituents in heat-resistant alloys is under investigation. Studies are being carried out to select suitable polishing, etching, and rinsing procedures for preparing specimens of 16-25-6, S816, Inconel-X, and low-carbon N-155 alloys for electron-diffraction studies. Results include the identification of a CbC-CbN phase in N-155 and S816 alloys and of an M_6C phase in 16-25-6 alloy. Strong indications of an $M_{23}C_6$ carbide and of a face-centered cubic phase with a unit-cell edge of 6.0 Å have also been obtained for N-155 alloy. Further studies, directed toward the correlation of the occurrence of the minor phases with the metallurgical treatments and microstructures of the alloy specimens, are in progress. (auth)

230

Corrosion Research Lab., Univ. of Texas
FINAL REPORT FOR THE PERIOD JUNE 1, 1946-AUGUST 31, 1951. 130p. Contract N5ori-136, Project Order 2. (ATI-170752)

Sorption of Gases on Metal Powders and Subsequent Change in Metal Reactivity at Room Temperature. The amounts of Cl_2 , NO_2 , O_2 , and CO taken up by powders of stainless steel, Ni, Cr, and Mo were measured at room temperature. CO was adsorbed on stainless steel and Ni powders, forming a chemisorbed layer. The other gases appeared to diffuse into the metals and then to react with them. O_2 retarded the dissolution of stainless steel and Ni in dilute acid solutions, but had the opposite effect on Cr. CO increased the induction period for Cr and the dissolution of Ni. An Improved Apparatus for Measuring Contact Potentials of Pure Metals. An apparatus in which the contact potentials of evaporated metal films can be measured both in vacuum and in gases at low pressures is described. The operation of the apparatus is discussed in detail. Adsorption of Polar Organic Compounds on Steel. A portion of the surface of steel powder is specific to the irreversible adsorption of alkyl carboxy acids, amines, alcohols, and esters. The alcohols and esters are not adsorbed to the same extent as the acids, and do not adsorb on surfaces on which acids are already adsorbed. Adsorption isotherms, determined as a function of concentration, were measured at 30°C for a number of organic materials adsorbed from benzene solution on steel powder. Surface Reactions of Steel in Dilute Chromate Solutions. The interactions between a steel surface and Cr^{+6} were studied by radiotracer methods and contact potential measurements. At high Cr concentrations the steel is passive. In dilute solutions the chromate ion adsorbed on cathodic areas. Surface Reactions of Cr in Dilute Chromate Solutions. The adsorption of chromate on Cr occurs in a monolayer. The presence of hydroxyl, sulfate, or chloride ions reduced the adsorption. (For preceding report in series see NP-1859.) (J.S.R.)

231

Oak Ridge National Lab.
HEAT CAPACITY OF TWO SAMPLES OF 310 STAINLESS STEEL AND OF A BRAZING COMPOUND. W. D. Powers and G. C. Blalock. Sept. 18, 1953. 9p. (CF-53-9-98)

The enthalpy and heat capacity of two specific samples of 310 stainless steel and of one sample of a brazing compound were determined. The measurements were made by

dropping the sample contained in a welded inconel capsule from a furnace into a Bunsen ice calorimeter. In this method the difference in enthalpy of the sample between the furnace temperature and 0°C is measured directly by the volume change caused by the melting of ice in the calorimeter. Corrections are made for the enthalpy of the capsule. The relationship between the enthalpy and temperature is determined by least squares. The heat capacity is the derivative of the enthalpy with respect to temperature. (auth)

232

Armour Research Foundation
PHASE DIAGRAMS OF ZIRCONIUM-BASE BINARY ALLOYS. REPORT 12. THE ZIRCONIUM-NITROGEN SYSTEM. REPORT 2. JULY 1, 1953-SEPTEMBER 30, 1953. R. F. Domagala and D. J. McPherson. Sept. 30, 1953. 16p. (COO-188)

As pure ZrN is unavailable commercially, an attempt was made to prepare it by passing purified N over Zr at 1000°C. The results of the nitriding work was summarized. The hardness and the α - β transformation of iodide Zr were checked. Alloys were prepared in the 0.1 to 3.0% N range. Preliminary annealing studies were made. (For preceding period see COO-187.) (J.S.R.)

233

Carnegie Inst. of Tech.
INVESTIGATION OF THE STATISTICAL NATURE OF THE FATIGUE OF METALS. G. E. Dieter and R. F. Mehl. Sept. 1953. 25p. (NACA-TN-3019)

Results are presented of an investigation of the statistical nature of the fatigue of metals utilizing statistical methods developed previously. The investigation included a study of the fatigue properties and their statistical variation of a plain C eutectoid steel heat-treated to coarse pearlitic and spheroidized structures of the same tensile strength, and of commercially pure Al (2S) and 24S alloy heat-treated to 2 different structures. Calculation of data from the literature provided statistics for 75S Al alloy for comparison with the data of the present investigation. (NACA)

234

Babcock and Wilcox Co.
EROSION AND HEAT TRANSFER WITH MOLTEN LITHIUM; FINAL REPORT FOR JANUARY 1, 1950 TO APRIL 30, 1951. H. G. Elrod, Jr., R. R. Fouse, and Paul B. Richards. Apr. 30, 1951. 52p. (NEPA-1837; B and W-5217)

235

Georgia Inst. of Tech. State Engineering Experiment Station
RESEARCH ON SURFACE PROPERTIES OF FINE PARTICLES; QUARTERLY REPORT. J. M. Dallavalle, Clyde Orr, Jr., and H. G. Blocker. Oct. 30, 1952. 37p. (NP-4811; AD-723; Quarterly Report 6)

The catalytic abilities of eight Ni powders, produced from the same mass of Ni(OH)₂ but being of different size fractions and/or having been reduced to the metal at different temperatures, were evaluated by the liquid-phase hydrogenation of oleic acid and the gas-phase hydrogenation of benzene. Some of the powders were found to be much better catalysts than others. Measurements of the energy effects accompanying the adsorption of N gas on a sample of each of the Ni powders at various pressures and at the temperature of liquid N have been made. The quantities of N gas adsorbed by Ni samples at various pressures and at the temperature of liquid N have also been measured. Data from the first set of measurements permit the calculation of the heat of adsorption, while data from the latter measurements permit the calculation of the specific surface area of the Ni powders. Calorimetric data, when liquid N was used, was shown to be reproducible and accurate to about 3%. Attempts were made to use CO₂ snow as the constant-

temperature medium and, hence, to measure heats of adsorption or chemisorption at a temperature above that of liquid N, but the poor heat-transfer properties of the snow resulted in the loss from the system of an appreciable percentage of the energy put into the system. While the energy resulting from the chemisorption of H₂ gas by one Ni sample at the solid CO₂ temperature was measured, the result may be questioned. (auth)

236

Rem-Cru Titanium, Inc.
THE DESIGN, CONSTRUCTION AND OPERATION OF A 25-POUND, BOTTOM-POUR, SKULL, ARC MELTING FURNACE; DEVELOPMENT OF PRODUCTION OF TITANIUM ALLOY CASTINGS FOR ORDNANCE APPLICATION. INTERIM TECHNICAL REPORT. Jan. 22, 1953. 109p. (NP-4894; Interim Technical Report 1)

A furnace capable of contamination-free melting and casting of from 3 to 30 lb of Ti and Ti-base alloys was designed, built, and successfully operated. Sound, tough, strong, homogeneous Ti alloy castings was made. Titanium alloy shapes with good surface and dimensional characteristics were cast. (auth)

237

Rem-Cru Titanium, Inc.
THE REHABILITATION AND OPERATION OF A 100-POUND, TILT-POUR, SKULL, ARC MELTING FURNACE; DEVELOPMENT OF PRODUCTION OF TITANIUM ALLOYS CASTINGS FOR ORDNANCE APPLICATION. INTERIM TECHNICAL REPORT. Jan. 28, 1953. 107p. (NP-4895; Interim Technical Report 2)

A 100-lb, tilt-pour, skull, arc melting furnace for production of Ti alloys castings was rehabilitated. This comprised the redesign and construction of new electrode motion control mechanisms, the fitting of the various furnace parts into an existing vacuum vessel, the provision of a vacuum system, and a miscellany of other modifications. (auth)

238

Atomic Energy Project (Canada)
THE INTERMETALLIC PHASE NpBe₁₃. O. J. C. Runnalls. [1952?] 3p. (NP-4913)

X-ray-diffraction patterns of Np-Be alloys showed that only one intermediate phase exists between the limits alpha Np and Be at room temperature. This phase has a composition approximating NpBe₁₃ and was not melted by heating to 1400°C. The alloy produced at the latter temperature was crystalline and loosely sintered. The compound is face-centered cubic and is isostructural with UBe₁₃. The lattice constant decreases from 10.266 ± 0.001 Å on the Be-rich side to 10.256 ± 0.001 Å on the Np-rich side, indicating some small range of solid solubility. The powder-diffraction data for NpBe₁₃ are given. The refined parameters, y = 0.1806 and z = 0.1192, were used in fixing the atom positions and in calculating the interatomic distances in the NpBe₁₃ unit cell. (J.A.G.)

239

Metallurgical Advisory Committee on Titanium
MINUTES OF SECOND MEETING OF PANEL ON METHODS OF ANALYSIS OF THE METALLURGICAL ADVISORY COMMITTEE ON TITANIUM AT HOTEL NEW YORKER, NEW YORK [ON] APRIL 23-24, 1953. 22p. (NP-4915)

The results of the cooperative studies and techniques used in spectrographic, chemical, and vacuum methods of Ti analysis are briefly outlined. (J.E.D.)

240

Metallurgical Advisory Committee on Titanium
LIST OF KNOWN TITANIUM RESEARCH AND DEVELOPMENT PROJECTS. INFORMATION BULLETIN NO. T6. ([SUPERSEDES] BULLETIN T3). June 1953. 40p. (NP-4916)

241

Institute for Cooperative Research, Johns Hopkins Univ.
GRAIN BOUNDARY EFFECTS IN PLASTIC DEFORMATION
AND POLYGONIZATION IN METALS. INTERACTION OF
SLIP BANDS WITH A GRAIN BOUNDARY. TECHNICAL
REPORT NO. 1 FOR THE PERIOD JANUARY 1, 1953 TO
OCTOBER 30, 1953. N. K. Chen and L. L. France. 27p.
Contract DA-36-034-ORD-1153RD. (NP-4927; Technical
Report No. 1)

Slip characteristics in the immediate vicinity of a grain boundary were studied in 8 Al bicrystals, extended at room temperature, by means of motion picture technique (at X 100) and metallographic observations (at X 1000). Direct evidence was obtained in support of the Zener and Frank hypothesis that slip bands from one grain can initiate or activate slip bands in an adjacent grain. Two main factors have been found to affect this slip activation process: (1) the octahedral orientation difference between 2 grains and (2) the geometry of the grain boundary with respect to the operative slip planes. These results are discussed in association with previous work on mechanical effect of crystal boundaries. (auth)

242

Utah Univ.
THE HIGH TEMPERATURE, HIGH PRESSURE OXIDATION
OF METALS. PROGRESS REPORT NO. 7. MAY 28 TO
AUGUST 28, 1953. W. Martin Fassell, Jr. and Robert C.
Peterson. Aug. 28, 1953. 8p. Contract DA-04-495-ORD-
237. (NP-4943)

The oxidation rate of Mo has been measured at temperatures of 500 to 650°C and at pressures of 14.7 to 400 psi. In this region Mo oxidizes according to a linear equation. No detectable amount of MoO₃ was lost from the sample by volatilization of the oxide. (J.S.R.)

243

Institute of Science and Tech., Univ. of Ark.
RECRYSTALLIZATION OF ALUMINUM OXIDE. PROGRESS
REPORT FOR THE PERIOD MARCH 15, 1953 THROUGH
SEPTEMBER 15, 1953. Sept. 25, 1953. 22p. (ORO-103)

Linear shrinkage upon firing of pressed alumina pellets, with and without additives, was used as an indication of recrystallization (grain growth) of alumina. The amount of addition was normally one wt. %. TiO₂, Ti₂O₃, and Nb₂O₅ additions were quite effective in increasing grain growth of alumina. MnO, Cu oxides, and GeO₂ promoted slightly the grain growth. Several compounds, some of which are isomorphous with alumina, were found to have no significant effect on the recrystallization of Al₂O₃. The halides were particularly effective in reducing grain growth, followed closely by Sb₂O₅. Controlled atmosphere tests showed that neither reduced pressure nor a small amount of gaseous N affected the alumina recrystallization. On the other hand, even a small amount of gaseous Cl was sufficient to reduce the grain growth, and the effect increased directly with concentration of Cl. Petrographic examination showed that the complete transition of A-11 alumina to α alumina was definitely retarded by the addition of Sb₂O₅ or NaF. The addition of MgF₂ produced a similar effect and also provided the magnesia to form some spinel. The addition of CaF₂ may have allowed the formation of some Ca₃Al₂O₆. The action of additives to induce recrystallization of alumina probably depends upon either the formation of a solid solution which distorts the alumina lattice to the extent that material transport and diffusion is increased or the formation of a liquid phase which is sufficient to increase these diffusion effects. Compounds which were found to retard the recrystallization of alumina contained effective "ions" of the "noble gas" type structure, and the charge of the "ion" seemed to affect also its ability to retard the grain

growth of alumina. It is believed that these "ions" could enter the alumina structure to fill vacancies and thereby reduce its tendency to recrystallize. (auth)

244

Battelle Memorial Inst.
CAUSES OF CRACKING IN HIGH-STRENGTH WELD
METALS. A. J. Williams, A. J. Jacobs, P. J. Rieppel,
and C. B. Voldrich. Nov. 1952. 48p. (WADC-TR-52-
322(pt.1); AD-5004)

245

Materials Lab., Wright Air Development Center
THE TENTATIVE TITANIUM-SILVER BINARY SYSTEM.
Henry K. Adenstedt and William R. Freeman, Jr. Apr.
1953. 28p. (WADC-TR-53-109(pt.1))

Ag is a β former when alloyed in small amounts with Ti. There is a large range of solubility of Ag in α Ti, and it reaches a maximum of 9 ± 1 wt. % Ag at $1560 \pm 7^\circ\text{F}$, at which temperature the eutectoid reaction $\beta \rightleftharpoons \alpha + \text{TiAg}$ occurs at 17 ± 0.5 wt. % Ag. The β solid solubility increases to 30.5 ± 1 wt. % Ag at $1903 \pm 5^\circ\text{F}$. Contrary to general opinion, the existence of the compound TiAg (69.25 wt. % Ag) has been established. It is formed at $1903 \pm 5^\circ\text{F}$ by the following peritectic reaction: $\beta + \text{Liq.} \rightleftharpoons \text{TiAg}$. The composition limits of the compound have, as yet, not been determined; however, the compound field appears to be narrow from preliminary observations. Ti is soluble in Ag in an amount of less than 0.5 wt. % as 2 phases are present in 99.5 wt. % Ag as-cast alloys. (auth)

246

Armour Research Foundation
RESEARCH AND DEVELOPMENT TOWARD IMPROVING
TITANIUM-ALUMINUM BINARY ALLOYS BY THE ADDI-
TION OF A THIRD COMPONENT. INTERIM TECHNICAL
REPORT NO. 5 [FOR] JANUARY 1, 1953-APRIL 30, 1953.
C. Robert Lillie and H. D. Kessler. 35p. Contract DA-11-
022-ORD-244. (WAL-401/103-27)

A study was made of effects of the addition of other elements to binary Al-Ti alloys to produce alloys superior to those now available, both in strength and toughness. The time-temperature-transformation and age-hardening characteristics of six Ti-Al-Fe and six Ti-Al-V alloys were determined. On the basis of these results, six aging treatments were applied to each alloy. All of these alloys were quenched from the beta solution temperature into iced brine in an attempt to avoid aging during quenching. (auth)

247

New York Univ. Coll. of Engineering
BETA PLASTICITY IN TITANIUM-BASE ALLOYS.
INTERIM TECHNICAL REPORT NO. 1. P. Albert and
I. Cadoff. July 31, 1953. 35p. Contract DA-30-069-ord-
869. (WAL-401/147-13)

Determination of the modes of deformation in β titanium alloys is reported. Large crystals for slip studies on β alloys were prepared by a thermal-gradient technique. Determinations of the cleavage and slip planes, and of drawing textures, were made for several β alloys. An apparatus was designed to facilitate rolling-texture determinations by the Geiger-counter x-ray goniometer technique. Of the several binary alloying elements which stabilize β to room temperature, only alloys with Mo and V have the properties desirable for the conduct of this investigation. Binary alloys with 20 to 25% Mo and those with 20 to 30% V retain β completely even when stressed. (auth)

248

Columbia Univ.
RESEARCH ON THE EFFECT OF PLASTIC DEFORMA-
TION ON TRANSFORMATION IN TITANIUM ALLOYS.
INTERIM REPORT NO. 2. E. S. Machlin, A. Hendrickson,

and S. Weinig. Mar. 1953. 44p. Contract DA-30-069-ord-547. (WAL-401/148-8; CU-8-53-ord-547-Met.)

The stress-strain behavior of Ti-Mo alloys after various heat-treatments yielding different degrees of thermal stabilization were studied. The results were analyzed in terms of the contributions to the total strain from two sources: slip in α' , and transformation strain. The ductility of Ti-Cr alloys (metastable β structure) was investigated in the embrittling range. (auth)

246

Metallurgical Labs., Sylvania Electric Products, Inc. THE MECHANISM OF PLASTIC FLOW IN TITANIUM. THIRD QUARTERLY PROGRESS REPORT [COVERING PERIOD] MAY 1, 1951 TO AUGUST 1, 1951. C. A. Dube, F. D. Rosi, B. H. Alexander, and F. C. Perkins. Issued Oct. 26, 1951. 27p. Contract AF-33-038-16031. (YE51-0443; ATI-122552; Quarterly Progress Report 3)

250

A POSSIBILITY OF ELECTRONS' BEING DETACHED FROM METALS BY MOLECULES OF A NEUTRAL GAS WITH ELECTRONEGATIVE PROPERTIES. S. V. Izmailov and A. M. Furman. Translated by E. R. Hope from Zhur. Eksptl'. i Teoret. Fiz. 20, 729-33(1950). 10p. (AEC-tr-1315)

A brief abstract of this report appears in Nuclear Science Abstracts as NSA 5-1594.)

251

CATHODIC SPUTTERING OF ALLOYS. Josef Mazur. Translated by Margaret VanNess from Polska Akad. Umiejtnosci Biuletyn SA, 81-92(1925). 9p. (AEC-tr-1696)

Techniques are described and some results are presented from a study of cathodic sputtering of various alloys. Particular attention was directed to the question of the differentiation of the components of the disintegrated alloy and the constitution of the layer deposited by cathodic sputtering. (L.M.T.)

252

DESCALING OF METALS WITH SODIUM HYDRIDE. Translated by W. Keitel from Metalloberflache 1B, 53-4 (1949). 5p. (NAA-AL-1454; ATI-153617)

Metals with oxide coatings can be cleaned by dipping them into baths of NaH and molten NaOH. This method has the following advantages: there is no loss of metal; there is no acid brittleness due to H pickup; no harmful gases are produced; overpickling is impossible; the treatment requires, at the most, only a few minutes; and there is little sedimentation. (J.S.R.)

253

THE ELECTRIC SPARK SHARPENING OF CUTTING TOOLS WITH BLADES OF HARD ALLOYS. B. N. Zolotikh. Translated from Stanki i Instrument 18, 23-4(1947). 6p. (AEC-tr-1708)

254

CHANGE IN SUPERCONDUCTING PROPERTIES OF TANTALUM SATURATED WITH HYDROGEN. V. R. Golik, G. B. Lazerev, and V. I. Khotkevich. Translated by M. Ostrofsky from Zhur. Eksptl'. i Teoret. Fiz. 19, 202-6 (1949). 10p. (AEC-tr-1725)

255

DISTRIBUTION OF MICROHARDNESS VALUES WITHIN A SINGLE CRYSTALLINE GRAIN OF METAL. A. A. Bochvar and O. S. Zhadaeva. Translated from Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk, 419-24(1947). 6p. (AERE-Trans-11/3/5/350)

The distribution of microhardness values was studied in (1) pure electrolytic Cu in the cast state, (2) the same in the deformed and subsequently annealed state, (3) α Cu-Zn homogeneous solid solutions extruded at high temperature, and (4) cast, very pure Al. The boundaries of the individual

grains were revealed on the polished surface of the samples by preliminary etching of the individual grains, and impressions were made with a diamond pyramid under a load of 2 g in parallel rows at definite equal intervals within a single rather large grain. After a fairly large number of impressions, measurements were made of the diagonals, the microhardness was calculated, and graphs were constructed of microhardness along a rectilinear sector within the grain. (L.M.T.)

256

THE AGEING OF ALLOYS OF ALUMINIUM WITH ZINC AND LITHIUM. T. A. Badaeva and F. I. Shamrai. Translated by S. Klemantaski from Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk, 99-107(1943). 16p. (AEC-tr-1539)

The aging characteristics of Al-Zn-Li and Al-Zn alloys in the region of α solid solution was studied by the methods of hardening and hardness. Very small quantities of Li (0.06 to 0.08%) added to Al-Zn alloys (9.0% Zn) produced a sharp increase in the effects of natural aging. The hardness of some of these Al-Li-Zn alloys after natural aging sometimes exceeds the hardness after artificial aging, while for Al-Zn alloys the hardness after natural aging is always considerably less than after artificial aging. (L.M.T.)

257

INVESTIGATION OF ALUMINUM COMPOUNDS FORMING AT HIGH TEMPERATURES. M. S. Beletskii and M. B. Rapoport. Translated from Doklady Akad. Nauk S.S.S.R. 80, 751-4(1951). 4p. (AERE-Trans-11/3/5/274; AEC-tr-1586)

During an experiment on the reduction of Al_2O_3 by C in the presence of silica at 1800°, fine elongated crystals were formed which were high in Al content. A discussion follows on the formation and constitution of these crystals, and, despite some inconsistencies with theory, it is concluded that the compound is Al_2O . (K.S.)

258

THERMIONIC EMISSION IN FERROMAGNETICS. A. V. Sokolov and A. Z. Veksler. Translated from Doklady Akad. Nauk S.S.S.R. 81, 27-30(1951). 11p. (AEC-tr-1731)

259

ON THE THEORY OF DECOMPOSITION OF AMALGAMS BY SOLUTIONS OF ELECTROLYTES. O. L. Kaptan and Z. A. Iofa. Translated from Zhur. Fiz. Khim. 26, 193-200 (1952). 15p. (AEC-tr-1715)

The decomposition of amalgams of alkali and alkaline earth metals by aqueous solutions of electrolytes represents a typical electrochemical process. The process of decomposition of amalgams consists of two interconnected electrochemical reactions. The first reaction is the ionization of the metal dissolved in Hg: $Me \rightleftharpoons Me^+ + e$. The second reaction is the discharge of H^+ in acid solutions, $H_3O^+ + e \rightarrow H_2O + H$, or in alkaline solution, $H_2O + e \rightarrow OH^- + H$. Expressions for the potentials of decomposition and the reaction kinetics of the amalgam in acid and alkaline solutions are derived. (J.S.R.)

260

DECOMPOSITION OF AMALGAMS AND OVERVOLTAGE OF HYDROGEN ON MERCURY IN ALKALINE SOLUTIONS. O. L. Kaptan and Z. A. Iofa. Translated from Zhur. Fiz. Khim. 26, 201-10(1952). 18p. (AEC-tr-1716)

It was proved that the decomposition of amalgams diluted by water mixtures of electrolytes in an electrochemical reaction limited by the speed of the H_2 discharge. Decomposition kinetics for amalgams of K, Li, and Ca were studied in solutions of their hydroxides, and kinetic formulas, deduced theoretically from the electrochemical theory of interlinking electrode processes, are given. The value for H_2 overvoltage on a Hg cathode in alkaline solution was found. The dependence of the amount of overvoltage on the

concentration of hydroxyl ions can be expressed as $\eta = 1.507 - 0.105 \log C_{OH^-}$. The influence of surface-active ions on the overvoltage of H_2 is discussed. (J.S.R.)

261

VELOCITY OF DECOMPOSITION OF SODIUM AMALGAM IN ALKALINE SOLUTIONS. G. I. Volkov and Z. L. Klitsa. Translated from Zhur. Priklad. Khim. 25, 154-8(1952). 11p. (AEC-tr-1711)

262

REACTIONS OF SOLID IRON WITH MELTS OF ALUMINUM AND ALUMINUM ALLOYS. Erich Gebhardt and Walter Obrowski. Translated by Margaret L. Schloo from Z. Metallkunde 44, 154-60(1953). 13p. (AEC-tr-1693)

An investigation of growth layers formed by the reaction of solid Fe with melts of Al and numerous Al alloys is reported. Thickness measurements of the growth layers, microhardness tests, chemical analyses, and x-ray-photographic investigations were utilized. Basically, 2 different growth formations could be observed, according to the composition of the melt reacting with the Fe. If the melt is pure Al, Al-rich, thick, very adherent alloy layers form on the Fe surface, which are indented into the Fe background in a characteristic way. They consist of 2 zones of different compositions; the outer, predominant zone was identified as Al_3Fe_2 . The inner seam, directly adjacent to the Fe, may be considered to be a region of α iron mixed crystals. The structure of the entire growth layer is practically unaltered when small amounts of Ba, Bi, Ca, Cd, Co, Cr, Cu, In, Mg, Mn, Ni, Sb, Si, Sn, Sr, Ti, V, or up to 1% Zn are added. These additions probably have a certain influence on the growth velocity of the alloy layer, however, which was determined experimentally in each case. It is noteworthy that a considerable hindrance of the growth was observed only when Si was added. In contrast to this, the covering layers are of a completely different nature when solid Fe and Al melts containing more than 1% Zn react with each other. In this case a voluminous growth layer is formed which had deep fissures and numerous pores or canals through which the attacking melt can penetrate the Fe sample. The layer apparently consists only of Al_3Fe . The unusual acceleration of the growth process is particularly characteristic of the effect of the Zn addition. The thickness of the layer formed can be 1000 times as great as that formed using unalloyed Al melts. Finally, observations on the unusual volume changes during reactions of Fe with Al and Zn are reported. 20 references. (auth)

263

THE EFFECT OF PLASTIC DEFORMATION ARISING DURING DECOMPOSITION OF A SOLID SOLUTION ON THE RATE OF GROWTH OF A NUCLEUS OF THE NEW PHASE. L. N. Aleksandrov and B. Ya. Lyubov. Translated from Doklady Akad. Nauk S.S.S.R. 91, 519-22(1953). 5p. (NSF-tr-95)

The problem of the rate of growth of a spherical nucleus of a new phase in a supercooled solid solution is examined. The effect of the plastic deformation arising at the surface of the nucleus as a result of the transformation is considered. Equations for the rate of growth are derived from the tensor components of the concentrated stresses inside the nucleus. The isothermal growth of ferrite grains in supercooled austenite of hypoeutectoid composition is used to illustrate the validity of the derivations. (J.S.R.)

264

BURNS FROM TEMPERING ON CAST PIECES OF LIGHT METAL ALLOYS BY THERMAL TREATMENT. Henry Garnier. Translated by Margaret Colven from Fonderie 85, 3307-12(1953). Oct. 1, 1953. 9p. (AEC-tr-1703)

Among the accidents liable to endanger the effect of thermal treatment on light metal alloy pieces, the most

serious is burning from tempering. This is produced by heating prior to tempering until the temperature of the beginning of fusion of the alloy is exceeded. A piece superheated by tempering may have an intact appearance, but if it has become fragile, it can be broken open under a very small strain and no further treatment can regenerate it. The circumstances which provoke superheating of light metal alloys during thermal treatment are reviewed, and the mechanism of deterioration by burning is discussed. Data are presented on characteristics permitting identification of a burn on pieces of a Cu-Fe-Mg-Si alloy. The mechanism of the deterioration of superheated samples of the alloy was investigated, and conclusions on the thermal treatment of the alloy are presented. The effect of casting method on burn production in light metal alloys was also investigated, and data are tabulated. (C.H.)

265

PHASE CHANGES DURING ELECTROSPARK TREATMENT OF METALS AND AN ATTEMPT TO ESTABLISH CRITERIA FOR THE OBSERVED INTERACTIONS. L. S. Palatnik. Translated from Doklady Akad. Nauk S.S.S.R. 89, 455-8(1953). 4p. (NSF-tr-53)

The structural changes caused in the surface layer of various metals subjected to electrospark treatment in air were studied. The conditions were 110 v, short-circuit current of 2 amp, and capacitances from 20 to 280 μf . An analysis of the experimental data led to the following conclusions on the change mechanism: (1) When a spark jumps, a "point source" of heat appears on the surface of the electrode and initiates local heating, melting, and evaporation in the "active region" of the electrode. (2) An estimate of the time of local heating of the "active region" of the electrode gives $t \approx L^2/K > 10^{-2} \text{ sec} \gg t_0$, where L is the diameter of the hole, K is the thermal conductivity, and t_0 is the duration of the spark discharge. (3) The observable metastable phases form as a result of "point" hardening. (4) After electrosparking, only in special cases does the phase composition of the surface layer of substances from the anode and cathode approximate the state described by the phase diagram. By structural x-ray analysis, measurements of microhardness, spectrum analysis, and microanalysis, it was found that three forms of transfer and interaction of the electrodes occur; coating of the cathode by the anode material, formation of alloys on the surface of the cathode, and the transfer of material from the cathode to the anode. If t_1 is the duration of local melting spots on the anode and t_2 is the duration on the cathode, coating of the cathode takes place when $t_1 < t_2$. If $t_1 \sim t_2$, the formation of alloys occurs. When $t_1 \gg t_2$, the anode is coated. (J.S.R.)

266

CHANGES IN THE LATTICE PARAMETER OF POLYCRYSTALLINE SOLID SOLUTIONS AND INTERCRYSTALLINE INTERNAL ADSORPTION. V. I. Arkharov and N. N. Skorniyakov. Translated from Doklady Akad. Nauk S.S.S.R. 89, 841-4(1953). 5p. (NSF-tr-96)

The change in the lattice parameter with successive increase and decrease in the grain size was observed in alloys of Cu with Sb, Be, and Fe. The Cu-Sb alloys have a larger parameter in the coarse-grained state than in the fine-grained state; for Cu-Be alloys the parameter change with grain size is reversed. With two or three admixtures, the change in the lattice parameters depends on their relative content. Fe does not change the lattice parameter. The complete results of the study are tabulated. (J.S.R.)

267

THE NONHOMOGENEITY OF AUSTENITE. I. A. Oding and M. G. Lozinsky. Translated from Doklady Akad. Nauk S.S.S.R. 89, 275-8(1953). 5p. (NSF-tr-52)

Austenite samples, 60 mm long and with a cross section of 30 mm², were heated electrically by use of an industrial frequency (50 cps) and low voltage (6 to 8 v). The increase of temperature along the sample was accompanied by an increase in the grain size. A narrow temperature zone was established which separated a region marked by recrystallization of large grains of austenite from a region in which the austenite grains had not changed their size. In this narrow zone the structure of both the old and the newly formed grains is preserved. (J.S.R.)

268

ULTRASONIC TESTING OF MATERIALS IN THE LIGHT METAL INDUSTRY. Josef Krautkrämer and Walter Roth. Translated by Margaret VanNess from *Z. Metallkunde* **44**, 198-205(1953). Sept. 2, 1953. 16p. (AEC-tr-1699)

250

NOTE ON THE PREPARATION OF THIN VANADIUM TARGETS. J. E. Schwager and L. A. Cox. *Rev. Sci. Instr.* **24**, 986(1953) Oct.

A method is described for the preparation of the V targets by electrically heating V pellets. Targets having effective thicknesses of 5 to 50 kv for 6-Mev deuterons have been made to withstand beam currents as high as 0.3 μ amp. (K.S.)

270

GADOLINIUM-MAGNESIUM ALLOYS RICH IN GADOLINIUM: PREPARATION AND MAGNETIC PROPERTIES. Francoise Gaume-Mahn. *Compt. rend.* **237**, 702-4(1953) Oct. 5. (In French)

Homogeneous alloys rich in Gd can be obtained by heating the alloy at 1100 to 1200°C and under 3 to 3.5 atm. of A. The coefficients of magnetism were studied as a function of the temperature (78 to 300°K) and of the field (60 to 7800 gauss). The alloys with 25 to 50 at. % Gd had one Curie point, $\theta_1 = 103 \pm 3^\circ\text{K}$; alloys with 50 to 90 at. % Gd had two Curie points, $\theta_1 = 103 \pm 3^\circ\text{K}$ and $\theta_2 = 266 \pm 3^\circ\text{K}$; and alloys with 90 to 100 at. % Gd had two Curie points, $\theta_2 = 266 \pm 3^\circ\text{K}$ and $\theta_3 = 289 \pm 2^\circ\text{K}$ (Curie point of pure Gd). The Curie points seem to indicate the formation of 4 combinations between Gd and Mg: GdMg₃, GdMg₂, GdMg, and an alloy with 90 at. % Gd. (J.S.R.)

271

CARBON IN THE ENGINEERING AND METALLURGICAL INDUSTRIES. II. INDUSTRIAL CARBONS. V. S. Kingswood. *Metallurgia* **48**, No. 287, 133-8(1953) Sept.

The industrial carbons and their uses are discussed. Details are given of the raw materials from which they are made and of the processes used in their production. Finally, reference is made to typical applications in selected industries. (auth)

272

HOT DIP ALUMINISING. M. L. Hughes and D. P. Moses. *Metallurgia* **48**, No. 287, 105-22(1953) Sept.

After reviewing the published information on the hot-dip aluminizing process and on the properties of the product, the authors describe work carried out on the subject in the laboratories of The British Iron & Steel Research Association at Swansea, as a result of which the preliminary treatment of the strip prior to aluminizing has been greatly simplified. The effect on the product of variations in the aluminizing process has been examined, including their influence on the properties of the steel base. Experimental batch aluminizing procedures and the operation of a pilot plant for continuous coating are described. Finally, the advantages and disadvantages of the process and its product are discussed. (auth)

273

EQUILIBRIUM OF SOLID α -SILVER-ZINC ALLOYS WITH ZINC VAPOR. George Scatchard and Roy A. Westlund, Jr. *J. Am. Chem. Soc.* **75**, 4189-93(1953) Sept. 5.

The vapor pressure of zinc from solid silver-zinc alloys has been measured by the absorption of the resonance line at 3076 Å. from pressures of about 1 mm. nearly to the melting point and through the range of α -alloys, 0 to 30% zinc. The vapor pressures are expressed analytically. The activity coefficient of zinc passes through a minimum and does not vary greatly with composition over this range. The corresponding partial entropy is surprisingly large and appears to persist in the liquid alloys. (auth)

PHYSICS

274

Los Alamos Scientific Lab.
FREON CASCADE REFRIGERATOR FOR LIQUID AIR PLANT PRECOOLER. William Ball and Robert G. Johns. *July 24, 1953*. 16p. Contract W-7405-eng-36. (LA-1584)

A method is described for increasing production from an air liquefier by lowering the temperature of the gas before admission to the liquefaction system. A refrigerator using Freon 13 and 22 is developed to maintain the "precooling" temperature, and an analysis is made of the energy expended to liquefy a unit mass of air. The energy required to liquefy air by this method is 3.14 kwh/gal. This method shows improvement by a factor of 1.7 over the simple Linde cycle with NH₃ precooling. (auth)

275

Institute for the Study of Rate Processes, Univ. of Utah
AN APPLICATION OF THE ABSOLUTE RATE THEORY TO PHASE CHANGES IN SOLIDS. TECHNICAL REPORT NO. 40. F. W. Cagle, Jr. and Henry Eyring. *Aug. 1, 1953*. 18p. Contract N7-onr-45101. (NP-4924; Technical Report No. 40)

276

Pittsburgh Univ.
SCHOTTKY DEFECTS IN SOLID SOLUTIONS. W. E. Wallace and R. A. Flinn. [July 1, 1953]. 4p. Contract AT(30-1)-647. (NYO-6158)

The Schottky defect, unoccupied lattice sites, in alkali halide solid solutions is caused by the distribution over a group of lattice sites of two or more ions differing appreciably in size. The size variation introduces stresses which lead to local lattice distortions and the occasional ejection of an ion. The magnitude of Schottky defects in alkali metal halide solid solutions is discussed. Experimental evidence shows they are more abundant than previously thought. Thermodynamic calculations of the energies of the solutions are in error because the lattice vacancies have been ignored. (J.S.R.)

277

Palmer Physical Lab., Princeton Univ.
THE POLARIZATION OF SODIUM ATOMS. W. B. Hawkins and R. H. Dicke. *June 15, 1953*. 7p. Contract AT(30-1)-937. (NYO-6179)

Sodium atoms have been polarized by passing them through circularly polarized resonance radiation. The energy level diagram, including the hyperfine structure, is given. The polarization ratio of the scattered light is graphed against the magnetic field applied along the axis defined by the incident beam. As the polarization effect is intensity-dependent, a multiple photon effect is indicated. (J.S.R.)

278

Armour Research Foundation
LOW TEMPERATURE LUBRICATING OIL ADDITIVES. G. Gavlin, S. P. Jones, Jr., and E. A. Swire. *Sept. 1952*. 39p. Contract AF33(038)-1644. (WADC-TR-52-22; AD-1133)

The mechanism of pour-point depression and the development of additives to permit the use of hydrocarbon lubricants at an ambient temperature of -65°F are reported. The mechanical behavior of Pennsylvania 150 Neutral oil in a rotational, concentric-cylinder viscometer at -25 and -30°C is described. The thixotropy consists of an irreversible part, predominant at low rates of shear and rapidly transient at high rates of shear, and a reversible part, predominant at high rates of shear. Temperature effects due to heat generated in shearing are of appreciable magnitude and account for a large part of the latter effect. The irreversible change in the system due to shearing is attributed to disruption of a fragile structure within the oil. The final condition for the completely sheared oil, in the limit of low rates of shear, is that of a Newtonian liquid. Dodecyl polymethacrylate, in concentrations of 1% or greater, prevents the formation of the rigid structure. However, an increase in initial viscosity was observed with increased methacrylate concentration. The rheology of a high pour-point system consisting of a suspension of *n*-octacosane in Pennsylvania 150 Neutral reveals a permanent decrease in viscosity as a function of the work done in shearing. Fractionation of dodecyl methacrylate polymers followed by a comparison of the additive activities of the fractions have shown that the highest average molecular weights attained, 10,000 to 14,000, are the most effective of all samples tested on 150 Neutral oil but that lower molecular weight materials of the order of 1,000 are the best pour-point depressors for relatively low molecular weight Mineral Seal oil. Corresponding series of *n*-alkyl methacrylates and *n*-alkyl acrylates having alkyl groups ranging from *n*-octyl to *n*-octadecyl were synthesized and polymerized under the conditions used to produce active dodecyl methacrylate polymers. By use of a flow-point determination for cooled oils as a measure of the temperature of gelation, dodecyl polymethacrylate was found to depress the flow point of *n*-octacosane-150 Neutral oil solutions as much as 35°F for oils having an initial flow point of no greater than 68°F but was inactive in concentrations up to 6% for mixtures having higher initial flow points. This additive was active toward *n*-octacosane-toluene blends. The action of diluents in the depression of viscosity pour points was found to be a function of the fluidity contribution of the diluent and independent of the diluent structure, except insofar as it determines fluidity. The viscosity of 150 Neutral oil is controllable by dodecyl polymethacrylate in the 0 to 20% concentration range between 150 and 3200 sus/ 100°F for pour points in the -35 to -50°F range. (auth)

279

THE THEORY OF FERROELECTRICITY. G. A. Smolenskii and R. E. Pasenkov. Translated by J. R. Fisher from *Doklady Akad. Nauk S.S.S.R.* **79**, 431-4(1951). 10p. (AEC-tr-1267)

280

THE ELECTRICAL CONDUCTIVITY OF CUPROUS OXIDE. A. I. [Andriyevsky] Andrievskii, V. I. Voloshchenko, and M. T. Mishchenko. Translated from *Doklady Akad. Nauk S.S.S.R.* **90**, 521-3(1953). 3p. (NSF-tr-90)

The basic elements in the polycrystalline structure of a Cu_2O layer are the crystalline grains, the intercrystalline layer, and the contact layer that separates the Cu_2O from the Cu. The role of these individual elements in the electrical conductivity of the Cu_2O layer was investigated. Samples of the oxide with different grain sizes were prepared by varying the oxidation time, by varying the temperature of the oxidizing atmosphere, and by using Cu plates of different initial thicknesses. Since the conductivity varied inversely with the size of the grains, it was

determined that the intercrystalline layer plays an important part in the conductivity. The specific conductivity of the Cu_2O layer is proportional to the number of grains per unit of surface area of the sample. (J.S.R.)

281

CONTRIBUTIONS TO THE EXPLANATION OF THE PHENOMENA CONNECTED WITH CATHODE SPUTTERING. Theodor Baum. Translated by Margaret Schloo from *Z. Physik* **40**, 686-707(1927). Aug. 31, 1953. 16p. (AEC-tr-1695)

It is proved by investigation that the sputtering action in a magnetic field is connected with an atomic evaporation process. (auth)

282

THE INFLUENCE OF FREE CARBON IN THE BINDER ON THE QUALITY OF ELECTRICAL CARBON OR ELECTRODE PARTS. V. N. Krylov, A. S. Polubelova, and A. G. Bogdanova. Translated from *Zhur. Priklad. Khim.* **23**, 365-9(1950). 5p. (AERE-Trans-11/3/5/349)

283

ATOMIC INTERACTION AT DISTANCES SMALLER THAN 5×10^{-9} CENTIMETERS. O. B. Firsov. Translated from *Doklady Akad. Nauk S.S.S.R.* **91**, 515-8(1953). 4p. (NSF-tr-94)

When atoms having a relative velocity much smaller than 10^8 cm/sec collide, the state of the electrons changes adiabatically in such a way that their energy depends only on the distance R . An equation for the potential energy of the atom is derived, $U(R) = (Z_1 Z_2 e^2 / R) \chi ([Z_1 + Z_2]^{1/2} (\text{me}^2 / \hbar^2) R)$, where $Z_1 Z_2 e^2 / R$ is the coulomb interaction between nuclei having charges $Z_1 e$ and $Z_2 e$ and χ is the universal function $\chi(x) = 1 - 1.8x + 1.6x^{3/2} - \dots \sim 100/x^3$. (J.S.R.)

284

PHOTOCONDUCTIVITY OF Cs-Sb LAYERS. P. G. Borzyak. Translated from *Zhur. Tekh. Fiz.* **20**, 923-7(1950). 10p. (AEC-tr-1728)

285

CALORIMETRIC METHOD FOR DETERMINING HEATS OF SOLUTION. Robert Fricke. Translated by Margaret Colven from *Z. Naturforsch.* **2A**, 39-46(1947). 16p. (AEC-tr-1733)

A new calorimeter, its thermal properties, and the determination of its water value are described. The Ag calorimeter vessel has a current of air flowing around it which, enclosed entirely in Al, maintains a constant temperature. The convergence temperature remains constant for several hours at exactly 0.0002° , and also the temporary temperature change occurring after heating or cooling is exactly reproducible and can be determined as a function of the calorimeter temperature once and for all time. To measure the water value, a known quantity of heat is supplied to the calorimeter through a heating unit, and the resulting temperature increase is determined. The accuracy of the water value determination is about 0.1%. (auth)

286

ON THE QUESTION OF SUPERCONDUCTIVITY OF CADMIUM. B. N. Samoilov. Translated from *Doklady Akad. Nauk S.S.S.R.* **81**, 791-4(1951). 13p. (AEC-tr-1727)

One of the usual methods of determining the superconductivity of metals is by measuring the resistance of the sample as a function of temperature and of the magnetic field. This method, however, is undesirable when investigating the superconductivity of samples having small critical fields. A method is described here for measuring changes in ohmic resistance of the sample rather than measuring its absolute value. In the investigation of the dependence of the critical field of Cd on temperature, the measurements were made at temperatures below 1°K , the low temperature being obtained by adiabatic demagnetization. (L.M.T.)

287

VERTICAL DISTRIBUTION OF PHOTOGRAPHICALLY ACTIVE PARTICLES EMITTED BY METALS IN ATMOSPHERIC CORROSION. I. L. Roikh. Translated by E. R. Hope from *Doklady Akad. Nauk S.S.S.R.* **70**, 253-6(1950). 7p. (AEC-tr-1729)

Clean metal strips of Al, Mg, and Zn were placed in a horizontal plane, and a photographic plate was set at angles between 16 and 90° with its emulsion side facing the active surface of the strip. The following results were obtained: (1) the particle emission is independent of the cleaning treatment; (2) the optical density is linearly dependent on the distance between metal and plate; (3) most particles were emitted from Zn, Al, and Mg, in that order; and (4) the particle count varies exponentially with distance from the metal. (L.M.T.)

288

KINETICS OF THE DESTRUCTION OF SUPERCONDUCTIVITY BY A HIGH FREQUENCY FIELD. I. M. Lifshits and M. I. Kaganov. Translated from *Doklady Akad. S.S.S.R.* **90**, 529-31(1953). 3p. (NSF-tr-91)

The kinetics of the destruction of superconductivity by an alternating field with frequency $\omega \approx 10^6 \text{ sec}^{-1}$ was investigated. A kinetic equation was derived from the Maxwell equations limited by certain boundary conditions: $-\partial H/\partial z = (-4\pi/c)J$; $\partial E/\partial z = (-1/c)(\partial H/\partial t)$; $H|_{z=0} = H_0(\omega t)$; $E|_{z=\xi(t)} = H_k(\xi'(t)/c)$; and $d\xi/dt = (H(\xi) - H_k)/H_k v_0$. (J.S.R.)

289

UNSOLVED PROBLEMS IN THE THEORY OF SEMICONDUCTORS. A. F. Ioffe. Translated by M. Ostrofsky from *Izvest. Akad. Nauk S.S.S.R. Ser. Fiz.* **15**, 477-86(1951). 24p. (AEC-tr-1730)

The present theory of semiconductors was constructed deductively by analogy with the quantum theory of metals. The large amount of recent experimental work on semiconductors, however, emphasizes the need to examine the fundamentals of this theory in the light of new facts. This report points out several cases wherein the present theory is inadequate and suggests concepts and areas of investigation whereby the present theory might be further developed and refined. (L.M.T.)

290

NEGATIVE IONS OF SELENIUM, TELLURIUM, ANTIMONY AND BISMUTH. V. M. Dukelskii [Dukelsky] and N. I. Ionov. Translated from *Doklady Akad. Nauk S.S.S.R.* **81**, 767-9(1951). 5p. (AEC-tr-1706)

The ions formed by the impact of slow electrons with the vapors of Se, Te, Sb, and Bi were analyzed with the aid of a magnetic mass spectrometer. Se formed the negative ions Se^- through Se_4^- and the positive ions Se^+ through Se_4^+ . The probability of Se negative-ion formation has a greater magnitude for electron energies less than 1 ev. Te formed the negative ion Te^- and the positive ions Te^+ , Te_2^+ , Te_3^+ , and Te_4^+ . The negative ions Sb^- , Sb_2^- , and Sb_3^- and the positive ions Sb^+ , Sb_2^+ , Sb_3^+ , and Sb_4^+ were observed. In the Bi vapors, the two negative ions Bi^- and Bi_2^- and the positive ions Bi^+ , Bi_2^+ , Bi_3^+ , and Bi_4^+ were observed. (J.S.R.)

291

THE NOMOGRAPHIC METHOD OF DETERMINING THE OPTIMUM PROJECTIVE TRANSFORMATION OF RECTILINEAR SCALES. M. V. Pentkovskii [Pentkovskiy.] Translated from *Doklady Akad. Nauk S.S.S.R.* **66**, 339-42 (1949). 8p. (AEC-tr-1721)

The construction of nomographs which will give the result with a predetermined degree of accuracy is one of the basic problems of practical nomography. This is attained by an appropriate projective transformation of the nomographs. A nomographic method for determining the optimum transformation of the projective scales is given. (J.S.R.)

292

ELECTROMIGRATION IN A CATION-EXCHANGE RESIN. III. CORRELATION OF SELF-DIFFUSION COEFFICIENTS OF IONS IN A CATION-EXCHANGE MEMBRANE TO ITS ELECTRICAL CONDUCTANCE. K. S. Spiegler and C. D. Coryell. *J. Phys. Chem.* **57**, 687-90(1953) Oct.

The self-diffusion coefficients of Na, Zn, and Ca ions in "Nepton CR-51" cation-exchange membranes were determined by observing the spread of radiotracers on the membranes. The values obtained by this method are compared to those calculated from the electrical conductance of the membranes by the Nernst-Einstein formula and to one value from the rate of isotopic exchange. The agreement is fairly good except for Ca and shows that the mechanisms of diffusion and electrical conductance in the membrane are similar; the observed discrepancies are believed to be due to electroosmosis. (auth)

AEROSOLS

293

DETERMINATION OF THE RADIOACTIVITY OF THE AIR. Hubert Garrigue. *Compt. rend.* **237**, 802-3(1953) Oct. 12. (In French)

The amount of radioactivity in air was measured from April to September at altitudes from 1460 to 3500 m. The results are tabulated. On Aug. 15, Aug. 28, and Sept. 5, 1953, a well-defined radioactive invasion was detected. No hypothesis was made as to its cause. (J.S.R.)

COSMIC RADIATION

294

A STUDY OF THE WIDTH OF SHOWERS OF COSMIC PARTICLES AT SEA LEVEL. L. Kh. Eidus, N. M. Blinova, V. G. Videnskii, and L. D. Suvorov. Translated by G. Belkov from *Doklady Akad. Nauk S.S.S.R.* **74**, 477-80 (1950). 10p. (TT-370)

A brief abstract of this report appears in *Nuclear Science Abstracts* as NSA 5-633.

295

AN INVESTIGATION OF THE NONIONIZING COMPONENT OF COSMIC RAYS IN THE STRATOSPHERE. V. S. Zarya, Yu. A. Smorodin, and Z. I. Tulina. Translated from *Doklady Akad. Nauk S.S.S.R.* **91**, 495-8(1953). 4p. (NSF-tr-103)

An abstract of this article appears in *Nuclear Science Abstracts* as NSA 7-6112.

296

ON THE QUESTION OF THE ABSORPTION CURVE OF THE PRIMARY PARTICLES OF COSMIC RADIATION. G. T. Zatsepyin. Translated by Henry P. Kramer from *Zhur. Eksptl'. i Teort. Fiz.* **19**, 1104-7(1949). 10p. (UCRL-Trans-74)

297

STUDY OF ELECTRON-NUCLEAR SHOWERS AND PENETRATING PARTICLES IN THE STRATOSPHERE AT VARIOUS LATITUDES. S. N. Vernov and A. N. Charakhchyan. Translated from *Doklady Akad. Nauk S.S.S.R.* **91**, 487-90(1953). 4p. (NSF-tr-102)

An abstract of this article appears in *Nuclear Science Abstracts* as NSA 7-6517.

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

298

Los Alamos Scientific Lab.

THE LONG-LIVED PHOSPHORESCENT COMPONENTS OF THALLIUM-ACTIVATED SODIUM IODIDE. C. R. Emigh and L. R. Megill. Aug. 25, 1953. 24p. (AECU-2734)

With a Co^{60} source as a means of primary irradiation, the long-lived phosphorescent decay of Tl-activated NaI crystal has been studied at a crystal temperature of $29.9 \pm 0.1^\circ\text{C}$.

A set of decay curves has been obtained by using different primary radiation exposure times varying from 5 sec to 120 hr. These curves have been arbitrarily analyzed in terms of exponential decay components. The following set of mean lives for the different trap depths are consistent with all these complex decay curves: 0.23 ± 0.04 , 0.92 ± 0.11 , 3.1 ± 0.3 , 8.8 ± 0.8 , 28 ± 3 , 90 ± 3 , and 510 ± 100 min. The initial intensities of the exponential components approach constant values with an increase in exposure time and, to a first-order approximation, follow a very simple mono-molecular trap theory. The effect on the mean lives due to a change in the crystal temperature is discussed. The data have been obtained with a 5819 photomultiplier as the detector and a vibrating reed electrometer to measure the current output of the photomultiplier. (auth)

299

THE PROBLEM OF THE OCCURRENCE OF SEIGNETTE-ELECTRICITY. G. A. Smolenskii [Smolensky] and N. V. [Kozhevnikova]. Translated from *Doklady Akad. Nauk S.S.S.R.* 76, [519-22](1951). 9p. (AEC-tr-1726)

The accumulated data on ferroelectric materials are reviewed with the aim of presenting a theory whereby ferroelectric properties may be predicted from an analysis of crystal structure. Experiments show that the ferroelectrics are crystals in which the O octahedra are arranged in a specific way and are fully or partly filled with cations arising from atoms with an unfilled penultimate shell and having an electronic structure of the noble gas type, a high charge, and a small ionic radius. (K.S.)

300

MUTUAL POLISHING OF DIFFERENT CRYSTALS. V. D. Kuznetsov. Translated from *Doklady Akad. Nauk S.S.S.R.* 89, 271-4(1953). 4p. (NSF-tr-51)

The anisotropy of crystals can be brought out by mutual polishing. This method is simpler and gives more definite results than the usual method of scratching. Experiments to show this were made on disthene, gypsum, mica-muscovite, LiSO_4 , pyrite, quartz, tourmaline, alum, magnetite, and wiluite. (J.S.R.)

301

FORMATION OF V-CENTERS IN ALKALI HALIDE CRYSTALS DURING THEIR ADDITIVE COLORATION IN HALOGEN VAPORS. L. M. Shamovskii [Shamovsky]. Translated from *Doklady Akad. Nauk S.S.S.R.* 91, 229-32(1953). 4p. (NSF-tr-98)

The mechanism of additive coloration of alkali halide crystals heated in a halogen atmosphere is discussed. During heating the halogen adsorbs on the external faces of a crystal and along the surface of its internal cracks. The holes formed are actually halogen atoms which have been ionized by taking the electrons of anions on the outer face of the crystal. Those holes migrate by successive exchange of electrons between an anion and a halogen next to it. The halogen holes are often associated with the vacant cation sites in the form of V-centers. The equilibrium concentration of V-centers, at constant temperature, is proportional to the pressure of the halogen vapor surrounding the crystal. (J.S.R.)

ELECTRICAL DISCHARGE

302

Johns Hopkins Univ. School of Engineering
THE ELECTRICAL STABILITY OF HIGH CURRENT ARCS IN AIR AND IN CONTROLLED GASEOUS MIXTURES. [Two reprints attached:] CHARACTERISTICS OF THE TUNGSTEN ARC IN ARGON-HELIUM MIXTURES. Merril Skolnik and T. B. Jones; SELF-GENERATED OSCILLATIONS IN THE D-C CARBON ARC. PART 2. THE HISSING ARC AND RADIO-FREQUENCY OSCILLATIONS.

Bernard H. List and T. B. Jones. Dec. 31, 1952. 23p. (AD-1765; Technical Report 2)

These studies were initiated to determine to what extent the electrical behavior of these welding arcs is influenced by various gaseous mixtures. The first paper is concerned with the general electrical characteristics of the W arc in mixtures of A and He over the entire range of possible percentages. It is noted that a mixture of ~70% He-30% A provides certain unique characteristics which should make this combination desirable for welding. The second paper is concerned with the electrical stability of d-c carbon arcs in air and in various gas mixtures. One of the principal indications of instability is the production of voltage and current oscillations in the arc. By means of high-speed motion-picture photography and a photographic technique employing the dual-beam oscilloscope, it was possible to definitely locate the source of these oscillations and to make quantitative measurements on the processes causing them to occur. (auth)

303

MEASUREMENT OF THE RATE OF MOTION OF THE MAIN CHANNEL OF HIGH-VOLTAGE DISCHARGE. I. S. Stekol'nikov. Translated from *Doklady Akad. Nauk S.S.S.R.* 85, 1013-16(1952). 8p. (AEC-tr-1732)

A brief abstract of this report appears in *Nuclear Science Abstracts* as NSA 7-3815.

304

CONCERNING THE EXCITATION OF ATOMS IN A MERCURY DISCHARGE. V. Fabrikant and B. Yavorskii. Translated from *Zhur. Eksptl'. i Teoret. Fiz.* 21, 1180-1(1951). 4p. (AEC-tr-1722)

305

CONCERNING THE EXCITATION OF ATOMS IN A MERCURY DISCHARGE. Yu. Kagan and N. Penkin. Translated from *Zhur. Eksptl'. i Teoret. Fiz.* 21, 1182-3(1951). 4p. (AEC-tr-1723)

ELECTRONS

306

DIOPTRIC OF ELECTRON-OPTICAL APPARATUS WITH ARBITRARY CURVED DIAGRAM AXES. Georg Wendt. Translated from *Z. Physik* 120, 720-40(1942-3). 26p. (AEC-tr-1710).

307

PHOTOGRAPHING WITH EXO- AND PHOTOELECTRONS. J. Kramer. Translated by Margaret VanNess from *Z. Physik* 135, 251-4(1953). Aug. 21, 1953. 6p. (AEC-tr-1694)

After exposure to x rays many nonmetallic crystals will give off exoelectrons and photoelectrons under the stimulus of ultraviolet light. The emission of the electrons can be used to activate the atoms of many substances and thus obtain a photograph. Photographs were made with gypsum, an oxidized Al plate, and an ordinary red brick. Examples are given. (J.S.R.)

308

ELECTRON-OPTICAL FOCUSING BY QUASISTATIC PATHS. Richard Wallaushek. Translated from *Z. Physik* 117, 565-74(1940-41). 13p. (AEC-tr-1709)

GASES

309

Cryogenic Lab., Ohio State Univ.
THE THERMODYNAMIC PROPERTIES OF THE GASEOUS CARBON MONOXIDE. Jack Belzer, Lydia G. Savedoff, and Herrick L. Johnston and E. R. Fultz, ed. May 1, 1953. 18p. (AD-11325; TR-316-6)

The thermodynamic functions of $\text{C}^{12}\text{O}^{16}$ have been calculated by the punch-card method from the latest values of

the fundamental physical constants and the most recent spectroscopic data available. The calculations cover the temperature range from 0 to 6000°K. (auth)

310

Naval Medical Research Inst., Bethesda
PHYSICAL ADSORPTION OF GASES ON SOLIDS. LECTURE AND REVIEW SERIES NO. 53-2. Terrell L. Hill. Mar. 11, 1953. 17p. (NP-4711; Lecture and Review Series No. 53-2)

A brief survey is given of the status of the problem of physical adsorption of gases on solids. Entropy as a thermodynamic function is discussed. Differential and molar integral entropy curves for N_2 adsorbed on graphon, calculated from 2 adsorption isotherms at 78.3 and 90.3°K, and the molar integral entropy of A adsorbed on rutile, calculated from a single adsorption isotherm combined with calorimetric measurements, are given as examples. The above 2 examples are also used as illustrations of the calculation of thermodynamic functions from experimental data. A qualitative summary of the status of the theory of physical multilayer adsorption is given. (J.A.G.)

311

Naval Research Lab., Univ. of Wis.
THE INTERMOLECULAR POTENTIALS OF HELIUM AND HYDROGEN AND [A TABLE OF] FORCE CONSTANTS FOR SOME [SIMPLE] NON POLAR MOLECULES. Edward A. Mason and William E. Rice. July 19, 1953. 53p. (WIS-ONR-3)

The transport-property collision integrals and the second virial coefficients have been evaluated for gases whose molecules obey an "exp-six" intermolecular potential. The Leonard-Jones procedure was used to evaluate potential parameters for He and H_2 . The viscosity, thermal conductivity, and the second virial coefficients have been calculated for He, H_2 , and He- H_2 mixtures from the potential parameters and compared with the experimental values. (J.S.R.)

INSTRUMENTS

312

[Fission Products Lab., Engineering Research Inst.,] Univ. of Mich.
[UTILIZATION OF FISSION PRODUCTS] AN ANALYSIS OF THE RADIATION FIELDS AROUND TWO GAMMA RADIATION SOURCES. John G. Lewis, John V. Nehemias, David E. Harmer, and Joseph J. Martin. [1953] 21p. (AECU-2709)

A detailed study of the radiation field surrounding two multi-kilocurie Co^{60} γ sources was completed. An analysis of the discrepancy between curie values based on dosage determinations and those based on reactor computations is presented. (auth)

313

Los Alamos Scientific Lab.
TWO TYPES OF TEMPERATURE REGULATORS FOR LIQUID HELIUM BATHS. H. S. Sommers, Jr. [1953?] 25p. (AECU-2715)

The design and performance of a pneumatic and an electronic regulator for He bath temperature are described. The pneumatic regulator, an automatic pressure regulating valve with large throughput, gives a simple controller suitable for regulation to a milli-degree for temperatures above 1.4°K. The electronic control uses a C resistor for the thermometer and a heater inside the bath for the control element. It showed high inherent stability and ease of operation. It is usable at all achievable temperatures. (auth)

314

Argonne National Lab.
DESIGN AND CONSTRUCTION OF NEEDLE THERMO-

COUPLES. W. Gerard Rauch. July 15, 1953. 12p. (ANL-5096)

Thermocouples of very small cross section can be successfully constructed essentially utilizing a hypodermic tubing and wire design. The choice of the component materials is dependent on environment and availability of small-diameter tubing. The central wire can be satisfactorily insulated from the tube with silicone resin impregnated double and triple layers of spun glass. Satisfactory couples consisting of an insulated constantan wire enclosed in an inconel tube were constructed and calibrated. These couples have a high thermoelectric power and hold their calibration well at temperatures up to 600°C. (auth)

315

Argonne National Lab.
INSTRUMENT RESEARCH AND DEVELOPMENT DIVISION
QUARTERLY PROGRESS REPORT FOR JUNE, JULY AND AUGUST, 1953. Francis R. Shonka. Sept. 1953. 18p. Contract W-31-109-eng-38. (ANL-5118)

An improved procedure for measuring the signal-to-noise ratio of photomultipliers is discussed, and results are presented graphically. A plastic scintillator of polyvinyltoluene containing 4% p-terphenyl and 0.02% 1,1,4,4-tetraphenylbutadiene was further tested and found to show a high transparency for the light of its own scintillations. Attempts to incorporate decaborane, $B_{10}H_{14}$, in a polyvinyltoluene scintillator for detection of thermal and epithermal neutrons have thus far proved unsuccessful. Preliminary tests of the photoelectric comparator are discussed. Volume-resistivity measurements on two lucite samples yielded a value 5×10^{17} ohm-cm. Changes in the fluorescence photometer are described. (For preceding period see ANL-5068.) (L.M.T.)

316

Bell Telephone Labs., Inc.
ENGINEERING SERVICES ON TRANSISTORS. SECOND QUARTERLY PROGRESS REPORT [FOR] AUGUST 1, 1951 TO OCTOBER 31, 1951. J. A. Morton, R. M. Ryder, D. E. Thomas, and C. Flannagan. 21p. Contract DA-36-039-sc-5589. (ATI-127751)

Circuits and performance data are presented for a low-drain transistor audio oscillator. (L.M.T.)

317

National Bureau of Standards
A BROADBAND, LOW-LEVEL, ERROR-VOLTAGE DETECTOR. M. L. Kuder. June 15, 1953. 24p. (NBS-2603)

An error-signal detector is discussed which can resolve relatively small signals with unusual broadband response and zero-drift stability. An r-f chopper principle replaced the more conventional mechanical choppers which have very limited bandwidth. Circuit and mechanical construction details are discussed. Experimental performance shows resolution to 1-mv with a bandwidth of at least 1 Mc. A zero-drift stability to 1 mv d-c is also readily attainable. Applications to high-speed multi-channel sampling, mechanical servos, etc., are discussed. (auth)

318

Office of Basic Instrumentation, National Bureau of Standards
SURVEY OF MILLIMICROSECOND OSCILLOGRAPHY. John H. Park. Sept. 1953. 28p. (NBS-2769)

The several factors which limit the speed of recording obtainable with cathode-ray oscillographs have been explained and discussed. Quantitative definitions of these factors have been chosen as a basis for comparing the high-speed characteristics of various makes and types of oscillographs. A survey of the manufacturers of high-speed cathode-ray tubes and oscillographs was made by

requesting data on these factors for each of their products. The results of this survey are presented. 43 references. (auth)

319

Florida Univ. Coll. of Engineering
A STUDY OF ELECTRONIC METHODS FOR THE MEASUREMENT OF SMALL DIRECT CURRENTS. John H. Searcy. June 1, 1953. 77p. (NP-4832)

A survey of methods employed for the measurement of small currents in the range from 10^{-11} to about 10^{-16} amp is presented with particular attention given to various methods of reducing drift in d-c amplifiers used for the measurement of such currents. The problems involved in designing a stable power supply are also considered. Experimental results obtained from three types of a-c operated electrometer amplifiers are presented. These are: (1) a unity feedback electrometer employing a Victoreen VX-41A tube, (2) a batteryless electrometer circuit employing a General Electric FP-54 tube, and (3) a new type of electrometer circuit utilizing nonlinear capacitors. (auth)

320

Institute for the Study of Rate Processes, Univ. of Utah
THE MEASUREMENT OF TEMPERATURE IN EXPLOSIVES. Franklin S. Harris, Jr. Aug. 31, 1953. 28p. (NP-4886)

A brief summary of methods of measuring high temperatures and their possible applicability to explosion conditions is presented. Methods which show promise are considered in more detail with regard to present and future possibilities. Relevant literature is cited in appropriate places. 124 references. (auth)

321

Radiation Lab., Univ. of Calif., Berkeley
TRANSISTOR CIRCUIT THEORY AND APPLICATIONS. Richard Madey. June 1953. 127p. Contract W-7405-eng-48. (UCRL-1985)

The small-signal analysis of the transistor is handled by the methods of network theory. The small-signal performance is evaluated in terms of the parameters of the equivalent-tee network. The negative-resistance concept forms the basis of the large-signal analysis. Applications are made to amplifiers, oscillators, gate circuits, and trigger circuits. (auth)

322

AN INTEGRATING PHOTOMETER FOR X-RAY INTENSITY MEASUREMENTS. E. Alexander, B. S. Fraenkel, A. Many, and I. T. Steinberger. *Rev. Sci. Instr.* **24**, 955-60(1953) Oct.

X-ray diffraction spots on films vary in area and are uneven in density. An instrument is described which, after calibration against a standard-intensity scale imprinted on the film, scans the spot by a light ray and transforms transmitted light pulses into linear functions of intensity by electronic means. A figure, proportional to the intensity of the spot, is obtained on a mechanical counter. The integrating process is fully automatic, and measurement of one spot takes about a minute. Reproducibility depends on the relative intensity of the measured spot, and can be raised up to 1%. (auth)

ISOTOPES

323

Fission Products Lab., Engineering Research Inst., Univ. of Mich.
[UTILIZATION OF FISSION PRODUCTS] PROBLEMS OF HANDLING A TEN-KILOCURIE GAMMA RADIATION SOURCE. L. E. Brownell, W. W. Meinke, J. V. Nehemias, and D. E. Harmer. [1953] 24p. (AECU-2712)
The design of a 10-kilocurie γ source consisting of 100

Co^{60} rods 0.25 in. in diameter and 10 in. long encased in Al pipe is described. Problems of handling the Co^{60} and shielding the source are discussed. (C.H.)

324

THE PHOTOCHEMICAL SEPARATION OF ISOTOPES. Bruce H. Billings, W. J. Hitchcock, and Murray Zelickoff. *J. Chem. Phys.* **21**, 1762-6(1953) Oct.

A method of successfully separating Hg isotopes by a photochemical process is described. The method involves the use of a monoisotopic resonance lamp as the source of light for the photochemical reaction. In this particular case a Hg^{198} lamp was used to excite only the Hg^{198} atoms. The excited Hg atoms react with water vapor to produce enriched HgO . In the first experiments an enrichment factor of 1.5 was obtained. The analysis of the isotopes was undertaken by the use of multilayer dielectric Fabry-Perot interferometers. (auth)

MASS SPECTROGRAPHY

325

Combustion Aerodynamics Lab., Harvard Univ.
VELOCITY SEPARATION OF IONIC MASSES FROM PULSED GROUPS. INTERIM TECHNICAL REPORT NO. 7. D. W. Batteau. Aug. 1953. 82p. Contract DA-19-020-ORD-1029. (NP-4923; Interim Technical Report No. 7)

Results are presented from a theoretical and experimental study of the separation of ionic masses from an initial group, or pulse, of ions by the resolution of the transit time for the different masses in passing through an electric field or fields. The pulses of ions are formed periodically at a suitable repetition rate to permit collection of all the ions in a given group before the next group is accelerated. This means of mass analysis permits a complete survey to be made in a fraction of a second so that rapidly changing compositions can be studied. It is also conceivable that such a device can be inexpensively made, occupy little space, and have small weight, permitting its inclusion in instrumentation where there is a premium on these factors. (auth)

326

A METHOD FOR THE MEASUREMENT OF THE ABUNDANCE OF ISOTOPES WITH A MASS SPECTROMETER IN THE PRESENCE OF RESIDUAL PEAKS. Miroslav M. Todorović. Translated from *Rec. trav. inst. recherches structure matière (Belgrade)* **1**, 111-13(1952). 4p. (AEC-tr-1713)

A method is described which permits obtaining as correct results with a contaminated mass spectrometer as with clean apparatus. The method of calculating the residual peaks is given, and calculated and recorded values are compared. (auth)

327

SOME OBSERVATIONS ON THE OPERATION OF AN ION SOURCE OF THE NIER TYPE OF A MASS SPECTROMETER. Miroslav M. Todorović. Translated from *Rec. trav. inst. recherches structure matière (Belgrade)* **1**, 95-101(1952). 8p. (AEC-tr-1712)

A discussion is presented of observations concerning the influence of certain parameters of an ion source of the Nier type on the intensity of the ion current and the value of the results. The influence of the filament is also mentioned. (auth)

328

MASS SPECTROGRAPHY AND SPECTROMETRY. Etienne Roth. Translated from *J. phys. radium* (8), **10**, 14d-6d (1949). 9p. (AEC-tr-1705)

A review of the principal applications of mass spectrometry and spectrography is given. (J.S.R.)

329

A NEW GENERAL PRINCIPLE OF EXTRACTION IN ION SOURCES. APPLICATION TO DIFFERENT TYPES OF SOURCES. PART 1. STATEMENT OF THE PRINCIPLE. PART 2. EXPERIMENTAL RESULTS. J. Sommeria. Translated from J. phys. radium 13, 645-9, 651-7(1952). 32p. (AEC-tr-1714)

A brief abstract of this report appears in Nuclear Science Abstracts as NSA 7-1811.

330

RATIO RECORDING IN ISOTOPIC ANALYSIS. C. M. Stevens and M. G. Inghram. Rev. Sci. Instr. 24, 987-9 (1953) Oct.

The modification of a mass spectrometer, using a ratio recording system in conjunction with surface ionization sources is described. A collector design modification improves the accuracy of the instrument by providing for constant multiplier gain only during that time necessary for a sweep from one isotope to another and improves the error due to elemental fractionation. A precision of 0.2% is indicated. (K.S.)

MATHEMATICS

331

Los Alamos Scientific Lab.
A NOTE ON THE DERIVATION OF THE CORIOLIS ACCELERATION. Robert M. Frank, Los Alamos Scientific Lab. and Florida State Univ. [nd] 16p. (AECU-2704)

A simplified vectorial derivation of the transformation to rotating coordinate systems is given. The facts that the Coriolis and centrifugal accelerations lie in the equatorial plane and that the Coriolis acceleration is normal to the equatorial component of the velocity are manifestly evident. The derivation is completely kinematic. (auth)

332

International Telemeter Corp.
THE MONTE-CARLO METHOD AS A NATURAL MODE OF EXPRESSION IN OPERATIONS RESEARCH. Gilbert W. King. [1952?] 10p. Contract N6-onr-228, T. O. 2. (ATI-189358)

Some basic aspects of the random walk are discussed in relation to diffusion theory applications and solutions by automatic computers. A general feeling for the approach to Monte Carlo methods is developed by reference to many illustrative situations of an operational and mathematical nature. (K.S.)

333

Oak Ridge National Lab.
DIFFERENTIAL EQUATIONS WITH DISCONTINUOUS COEFFICIENTS. Ward C. Sangren. Issued Oct. 21, 1953. 154p. Contract W-7405-eng-26. (ORNL-1566)

Solutions of multi-region and composite boundary value problems are sought by using the methods of variable separation and Laplace transforms. $N+1$ region or N interface problems are treated with emphasis placed on formal results. The Sturm-Liouville two-region system is rigorously considered. Two appendices are provided for expansion problems associated with composite cylinders and spheres. (K.S.)

MEASURING INSTRUMENTS AND TECHNIQUES

334

Los Alamos Scientific Lab.
Po α RANGES IN VARIOUS COUNTING MIXTURES. Grenfell P. Boicourt and John E. Brolley, Jr. [1953?] 4p. (AECU-2735)

In order to adjust pressures correctly in proportional counters and ionization chambers that employ Po α sources for standardization, the range relative to air in a number of

common gaseous fillings was measured. An illustration of the integral range curves are given. Also, the gas mixtures and their range ratios are given. (J.A.G.)

335

Tracerlab, Inc.
CHEMICAL SYSTEMS SENSITIVE TO RADIATION. MONTHLY REPORT NO. 9, MARCH 1, 1952-MARCH 31, 1952. Irving A. Bernstein, Elizabeth A. McElhill, Earle C. Farmer, and Florence F. Spalding. March 31, 1952. 9p. Contract DA-18-108-CML-2562. (ATI-156125; Monthly Report No. 9)

336

Tracerlab, Inc.
CHEMICAL SYSTEMS SENSITIVE TO RADIATION. MONTHLY REPORT NO. 11, MAY 1, 1952-MAY 31, 1952. Irving A. Bernstein, Elizabeth A. McElhill, Earle C. Farmer, and Florence F. Spalding. May 31, 1952. 14p. Contract DA-18-108-CML-2562. (ATI-156130; Monthly Report No. 11)

337

Tracerlab, Inc.
CHEMICAL SYSTEMS SENSITIVE TO RADIATION. MONTHLY REPORT NO. 14, AUGUST 1, 1952-AUGUST 31, 1952. Irving A. Bernstein, Wolfgang G. Rothschild, Florence F. Spalding, and Earle C. Farmer. Aug. 31, 1952. 11p. Contract DA-18-108-CML-2562. (ATI-170760; Monthly Report No. 14)

338

Hanford Works
DOUBLE CRYSTAL X-RAY SPECTROMETER FOR STUDY OF IRRADIATED MATERIALS. W. V. Cummings, Jr., D. C. Kaulitz, and M. J. Sanderson. June 9, 1953. Decl. Oct. 2, 1953. 37p. Contract W-31-109-eng-52. (HW-28331)

A double-crystal x-ray spectrometer has been developed which will be used to study the crystallographic features of irradiated materials. The design features of this instrument include: a mechanism to support and align the x-ray tube as it rotates on a conventional goniometer; a remotely controlled sample holder to position and rotate radioactive samples; a mechanism to adjust the position of a curved Al crystal which is placed in the second diffracting position in such a way that it focuses the diffracted x rays into the detector; and sufficient Pb shielding between the sample and detector to absorb the radiation emanating from the sample in order that such radiation will not influence the detector. Preliminary tests of the instrument have shown that the design features reduce the background radiation originating from the sample to a very low level and that no serious loss in diffracted x-ray intensities results from the double-crystal arrangement. (auth)

339

Mound Lab.
ABSOLUTE BETA COUNTING OF NATIONAL BUREAU OF STANDARDS SOLUTIONS. INFORMATION REPORT. M. L. Curtiss, D. L. Clark, and J. J. Dauby. Dec. 8, 1952. 13p. (MLM-801)

Two solutions of P^{32} and the one solution of I^{131} which had been calibrated at the National Bureau of Standards by means of 4π counting were assayed at Mound Lab. for the purpose of checking our techniques and instrumentation for absolute- β counting. Results of the assay of the first solution of P^{32} were from 6 to 14% higher than the Bureau of Standards value. The samples were counted periodically over a 4-month period, and results were found to increase with time, after correction to the reference date for decay. The thinnest samples gave the largest deviation upward from the Bureau values. This suggested the presence of a weak impurity with a longer half life than the P. A mathematical

analysis of the data, made on the assumption that only one impurity was present, indicated that there was 3.3% of a 25.4-day-half life impurity present at the Bureau of Standards reference date. The energy of the impurity, as determined from an absorption study, was approximately 0.12 Mev. A second solution of P^{32} and a solution of I^{131} gave good agreement with the Bureau of Standards calibration. Mound values were 1.3 and 2.4% lower than the Bureau values for the solutions. Small errors were indicated in the backscattering-correction factors used. (auth)

340

Radiation Physics Lab., National Bureau of Standards
PHOTOGRAPHIC DOSIMETRY. ANNUAL PROGRESS
REPORT [FOR] JULY 1, 1952 TO JULY 1, 1953. Margarete
Ehrlich and William L. McLaughlin. 77p. (NBS-2681)

Tests and developmental work on photographic dosimeters are reported. An account is given of the results of the evaluation of AEC personnel-monitoring procedures and of the tests carried out on a new film-scintillator dosimeter. Several phases of tests, developments, and services relating to atomic weapons test procedures are described, including a comparison study between the Los Alamos and National Bureau of Standards dosimeter-calibration procedures, a report on work leading to recommendations for film and absorber types to be used for a personnel field dosimeter, an account of the total dose determination services rendered in connection with the Nevada atomic weapons tests, and a report on the findings regarding neutron sensitivity of some of the film emulsions employed in these atomic weapons tests. (auth)

341

Naval School of Aviation Medicine, Pensacola
ABSOLUTE BETA MEASUREMENT OF TRITIUM BY
RADIOAUTOGRAPHY USING MONOLAYERS AS REFERENCE
SOURCES. Dietrich E. Beischer. July 15, 1953. 15p.
(NM-001-059.16.09)

This report recommends the utilization of tritium-labeled stearic acid monolayers as secondary standards in radioautography. The use of these reference sources allows an absolute measurement of the β radiation emitted by small areas of tritium-labeled specimens. Based upon the results of this study, recommendations for the most effective film material are made. The influence of an electrical charge of the specimen is described. (auth)

342

Centre de Physique Nucléaire de l'Université Libre de
Bruxelles
CONTROLE INTERFEROMETRIQUE DES PLÂTINES DE
MICROSCOPES DE MESURE. [INTERFEROMETRIC
CONTROL OF THE STAGES OF MEASURING MICRO-
SCOPES.] M. G. E. Cosyns. May 1953. 19p. (NP-4893;
Note No. 39)

An apparatus for controlling the movements of measuring microscopes is described. It permits the simultaneous control of rectilinearity, reproducibility, and hysteresis of the movements, both of the carriage and of the adjustment, for respective displacements of 46- and 3-mm with a precision of $\pm 0.014 \mu$ (fast control) to $\pm 0.0016 \mu$ (photographic control). The relative indications of the rectilinearity are given in absolute value, the instrument itself controlling its reference plane. (tr-auth)

343

New York Univ. Coll. of Engineering
PHYSICAL DEVELOPMENT OF NUCLEAR EMULSIONS.
(COSMIC RAY PROJECT). Raymond M. Chang. June 1,
1953. 41p. (NP-4914; Report 101.16)

The method of physically developing Ilford G5 unloaded nuclear-emulsion plates with an emulsion thickness of 200 μ is given. Formulas containing the processing time and

the optimum concentrations of the various components of the developer which were experimentally determined are also given. Results and advantages of this method of physical development are then compared to those obtained from the conventional method of chemically developing the nuclear emulsions. (auth)

344

Purdue Research Foundation
RESEARCH WITH CRYSTAL COUNTERS AND SCINTILLATION COUNTERS. PHOTOCONDUCTIVITY IN ANTHRACENE SOLUTIONS. L. W. Aukerman. May 30, 1953. 72p. Contract N7onr-39420. (NP-4920)

Measurements of photocurrent under various conditions of illumination and applied field were carried out on dilute solutions of anthracene in hexane by using conventional electrometer techniques. This system is capable of allowing an increase in conductivity of several orders of magnitude when illuminated with light in the far ultraviolet region. The possibility of an electrode effect is precluded. The behavior of the photocurrent indicates a bimolecular recombination of the carriers. Evidence is presented to illustrate the presence of ionic conductivity instead of electronic conductivity. Optical measurements show that the threshold for photoconductivity must lie in the 1900 Å region. The anthracene appears to be responsible for the absorption of the light in this region. These solutions are very inefficient when employed as liquid scintillators. (auth)

345

New York Univ.
FLUORESCENCE AND CONDUCTIVITY PHENOMENA.
PROGRESS REPORT NO. 8. Hartmut Kallmann. Aug.
1953. 40p. Contract DA-36-039-sc-5487. (NP-4930;
Progress Report No. 8)

The fluorescence of organic scintillators is theoretically considered, with particular emphasis on determining the lifetimes of the excited solute molecules. Results are presented from a measurement of fluorescent intensities of some pure phosphors when exposed to hard γ rays from Ra, β particles from Sr^{90} , and α particles from Po. The fluorescent intensity of NaCl(AgCl activated) crystals when exposed to 1 r/hr γ radiation was measured as a function of time. These results are combined with previous ones for a rather detailed analysis of the stimulation and phosphorescence of such crystals. (For preceding period see NP-4574.) (L.M.T.)

346

New York Univ.
FLUORESCENCE AND CONDUCTIVITY PHENOMENA.
PROGRESS REPORT NO. 1. Hartmut Kallmann. Sept.
1953. 73p. Contract DA-36-039-sc-42626. (NP-4931)

Energy transfer in a phenylcyclohexane solvent containing p-terphenyl was studied by observing the fluorescent-light output under γ irradiation as a function of the thickness of fluorescent solution with different amounts of a second solute (diphenylhexatriene and anthracene); at small concentrations (0.01 g/l) no energy transfer by collision takes place. Small amounts of aniline added to these solutions influenced mostly the terphenyl response to radiation, and to a lesser extent that of diphenylhexatriene. Results are given from studies of energy transfer (from measure of emitted-light intensity) from liquid and solid phenyl ether and diphenylmethane; in all cases energy transfer in the liquid was better. Studies are reported on the fluorescent output in tetralin solutions as a function of time. The relative fluorescent efficiencies of several different organic solutes in different organic solvents are summarized. A discussion is presented of refined experimental techniques for measuring the energy stored in phosphors after excita-

tion by high-energy radiation. The experimental method for detection of cosmic radiation with long columns of liquid scintillators is outlined and some results are presented. (For preceding period see NP-4930.) (L.M.T.)

347

El-Tronics, Inc.

DEVELOPMENT OF RADIACMETER AN/PDR-36(XE-1). FINAL PROGRESS REPORT FROM JUNE 1952 TO MAY 1953. Jack Levy. [1953] 22p. Contract DA-36-039-SCL-15546. (NP-4932)

The Radiacmeter AN/PDR-36(XE-1), designed and developed according to Signal Corps specifications, has been approved. This final report covers the development in detail, each component being discussed separately. (For preceding period see NP-4558.)

348

Technical Operations, Inc.

RESEARCH STUDY LEADING TO THE USE OF TRANSISTORS IN RADIAC SURVEY METERS. FINAL REPORT [FOR] JUNE 1, 1952 THROUGH AUGUST 15, 1953. Robert R. Smyth and Alan R. Pearlman. 111p. Contract DA36-039-sc-42482. (TOI-53-11)

The use of transistors, both point-contact and junction type, has been investigated in various circuits, with the over-all purpose being to determine the feasibility of employing transistors in radiac survey instruments. Transistorized circuitry and discussions are presented for a high-voltage supply, a geiger-tube counting rate meter, feedback electrometers, d-c amplifiers, and voltage regulators. Specific conclusions for the use of transistors in each of these components are presented, along with general conclusions on their use in radiac instruments. (For preceding period see TOI-53-5.) (L.M.T.)

349

Radiation Lab., Univ. of Calif., Berkeley

PHYSICS DIVISION QUARTERLY REPORT [FOR] MAY, JUNE, AND JULY 1953. Sept. 15, 1953. 34p. Contract W-7405-eng-48. (UCRL-2340)

Operation of an automatic developer for the 4- by 8-ft diffusion cloud chamber is discussed. Results of absolute mass determinations for π^+ and μ^+ mesons are presented. Decay characteristics of Ne^{16} are reported. Operation of a recently constructed ether bubble chamber is described. Tests are described on the Van de Graaff proton-beam chopper. The measured cross section for 2.8-Mev γ rays on C is 6 ± 1 times the classical Thomson cross section at 80° to 90° . Differential cross sections for deuteron and proton production at 40° to the beam resulting from proton bombardment of Li, C, Al, Cu, and Pb are reported. The design and preliminary testing of a high-energy γ -ray telescope are described. Total cross sections are presented for 33-, 44-, 56-, and 70-Mev mesons in H_2 . Development studies and operation of both the 60- and 184-in. cyclotrons are presented. The proposal to change the r-f dee voltage wave shape for the 60-in. cyclotron is discussed. The status of construction of the Bevatron is reported. (For preceding period see UCRL-2241.) (L.M.T.)

350

CONCERNING THE METHODOLOGY OF NEUTRON-PROBES. W. Bothe. Translated from *Z. Physik* 120, 437-49(1943). 19p. (AEC-tr-1691)

The errors which may arise in comparative measurements between neutron densities and neutron currents because of probes are discussed on a quantitative basis. Measurements made with Dy probes in paraffin and Al are shown to be in accordance with these calculations. The corrections to be added, as the case may require, can be computed accordingly. (auth)

351

SOLID STATE PHYSICS-DETECTION OF IONIZING PARTICLES BY MEANS OF SULFUR CRYSTALS.

M. Michel Georgesco. Translated by Henry P. Kramer from *Compt. rend.* 228, 383-5(1949). 6p. (UCRL-Trans-85; AEC-tr-1015)

Calculations which were carried out on a number of insulating crystals to determine ionization energies required to cause the appearance of a conductive region showed S, with a calculated potential of 5 ev, to be the most promising. An experimental apparatus was set up to test this, and the following results were obtained: (1) of 14 S crystals studied, all counted α particles, and 3 of them counted β particles; and (2) the amplitude of the pulses obtained with the equipment was proportional to the energy absorbed in the crystal. (L.M.T.)

352

ON THE ORIGIN OF THE VARIOUS EMISSION BANDS OF CaSb PHOSPHORS. V. F. Tunitskaya. Translated from *Doklady Akad. Nauk S.S.S.R.* 91, 507-10(1953). 5p. (NSF-tr-105)

Because of discrepancies in the literature on which bands in the luminescence spectrum of CaSb phosphors belong to Bi, a precise determination was carried out. Special attention was paid to the conditions of preparation of the phosphors and to the purifying of the initial components. It was established that the luminescence spectrum of CaSb consists of only one band which is attributable to Bi. (L.M.T.)

353

DIRECT MEASUREMENT OF GAMMA-RADIATION WITH A COUNTER. H. Maier-Leibnitz. Translated by Henry P. Kramer from *Z. Naturforsch.* 1, 243-52(1946). 22p. [contains no reproduced figures] (UCRL-Trans-42)

The purpose of this investigation was to determine the sensitivity to γ radiation within the energy range 0.05 to 3 Mev of counters constructed from various materials. This was accomplished by applying the coincidence method to the radiation from radioactive forms with simple decay schemes. The results of previous measurements with such forms were evaluated, and new observations were taken with radioactive Lu and Yb. The results were substantiated by the findings of other authors. The findings, first of all, indicated a dependence on the geometry of the apparatus. Therefore, auxiliary measurements were carried out in order to determine the relation between the probability of coincidence and the location of the source of radiation. By a simple calculation the collected data were compiled into sensitivity curves for counter tubes of Al, brass, Sn, and Pb. All counters are equally sensitive to energies exceeding 1 Mev. For lesser energies, there are large differences. The sensitivity of the Al counter varies strongly with the γ energy; that of the Pb counter varies the least. A counter of 0.2-mm Pb is equally sensitive to practically all radiation in the range 0.15 to 1.5 Mev. With a 2-mm brass counter, the sensitivity to the range 0.1 to 3 Mev varies almost linearly with the γ energy. (auth)

354

A LINEAR GATE CIRCUIT FOR PULSE-HEIGHT ANALYZERS. Paul R. Chagnon. *Rev. Sci. Instr.* 24, 990-1(1953) Oct.

A balanced-gate circuit with good linearity and stability characteristics for pulse-height analyzers is described. The system is linear within 1% and has a gain of about 2. Less than 2% drift of maximum output has been observed over a period of several hours, after initial tube aging. (K.S.)

355

DEVELOPMENT OF NUCLEAR EMULSIONS BY AN INDUCTION HEATING METHOD. Carolyn Lipetz and Frank

J. Loeffler. *Rev. Sci. Instr.* **24**, 999-1000(1953) Oct.

A method is described which reduces the time required to develop thick emulsions (100 to 600 μ). This procedure calls for the use of an electric induction coil in the warm-up period of the development process. It has been found that such treatment provides more uniform heating and subsequent development and that less softening of the gelatin occurs during warm-up. (K.S.)

356

A NUCLEAR EMULSION PLATE MOVER. G. W. Anderson, E. P. Ney, and R. B. Thorness. *Rev. Sci. Instr.* **24**, 997-8 (1953) Oct.

The time of incidence of a nuclear event in emulsions at balloon altitudes is measured by sliding one plate against another in close contact and at a known rate. A charged particle, penetrating both plates, leaves a track in each, and the measured displacement is then translated into time. A device based on this principle is described. In this application the plates are moved in steps, which, with an α -active calibration source, serves to locate the steps up to ± 0.1 min. (K.S.)

357

EXTRAPOLATION CHAMBER FOR THE MEASUREMENT OF BETA SOURCES. Robert Loevinger. *Rev. Sci. Instr.* **24**, 907-14(1953) Oct.

Construction and operation of a variable-spacing, parallel-plate ionization chamber is described. It has been designed for the measurement of β -particle sources of medical and biological interest. It has concentric collecting electrodes of 1-, 3-, 10-, and 30-mm diameter. The air gap in which ionization is measured can be adjusted from 0.04 to 10 mm. Ionization current is measured with a commercial vacuum tube voltmeter which has a full scale sensitivity of 2×10^{-13} amp. The instrument sensitivity is about 0.4 esu/cc-sec using a one-mm diam. collecting electrode with an air gap of 2 mm. Conditions are described in detail for the determination of ionization per cc in vanishingly small air gaps between polystyrene electrodes, with an accuracy of a few per cent. (auth)

358

GAMMA-RAY MEASUREMENTS BY THE MAGNETIC ANALYSIS OF COMPTON ELECTRONS. J. W. Motz, William Miller, H. O. Wyckoff, H. F. Gibson, and F. S. Kirn. *Rev. Sci. Instr.* **24**, 929-37(1953) Oct.

A magnetic spectrometer has been constructed which can be used to determine photon intensities and energies over an energy range of approximately 0.2 to 12 Mev. Over this energy range, the detection efficiency of the spectrometer is such that a monoenergetic photon flux density of the order of 10^5 photons/cm² will produce one count. The instrument measures the momentum distribution of Compton electrons ejected from a thin Be foil into a small solid angle in the direction of the incident photon beam. A method of converting these measurements to corresponding photon intensities and energies is presented. The calculations necessary to convert to photon intensities are based on the Klein-Nishina formula and include the effects of scattering and energy loss of the electrons in the foil. The spectrometer was calibrated from (a) the line shapes produced when the γ rays from the radioactive sources Cs¹³⁷ (0.661 Mev) and Na²⁴ (1.37 Mev, 2.76 Mev) were incident on the foil, and (b) the intensity measurements of these sources, obtained with an ionization chamber. (auth)

359

A TRITIUM MONITOR. T. O. Jeffries and M. E. Owen. *J. Sci. Instr.* **30**, 387-8(1953) Oct.

A continuous recording monitor for T concentrations in low-pressure gas targets (containing about 2 μ of T) is described. A Th-activated KI phosphor is used to detect β

radiation, and the collector current of a photomultiplier tube is calibrated directly in T concentration. (K.S.)

360

A PROPORTIONAL COUNTER SPECTROMETER FOR NEUTRONS. R. Giles. *Rev. Sci. Instr.* **24**, 986-7(1953) Oct.

A high-efficiency neutron counter is described which does not employ the principle of the thin radiator and recoil particle collimation. The counter is of the gas recoil type, and an anticoincidence method is used which prevents the counting of pulses due to nuclei which recoil in oblique directions to the chamber axis. (K.S.)

361

AN ERROR IN THE CORRECTION FORMULA FOR THE DEAD TIME OF A GEIGER-MÜLLER COUNTER. S. J. Wyard. *J. Sci. Instr.* **30**, 389(1953) Oct.

Departures from the equation $N_0 = N/(1-N\tau)$ for quenching-pulse corrections led to a measured discrepancy between the value of the dead time and the length of the quenching pulse. This discrepancy is shown to be due to the capacitive coupling between the counter and the probe unit. The correction equation therefore is modified by a substitution of τ_{eff} for τ , where $\tau_{eff} = 1 - (\frac{sV}{100})$, V = height of the quenching pulse, and s is the slope of the plateau in per cent. (K.S.)

362

INVESTIGATIONS ON BETA-RAY DOSIMETRY FOR A ³²P ENCLOSURE. M. McNally and G. J. Neary. *Brit. J. Radiol.* **28**, 539-47(1953) Oct.

The theory is developed for determining the surface dose rate of tissue masses of simple shape, subjected to whole surface irradiation by β rays in an enclosure, whose walls are thick sources of a β emitter. Two effects are described which increase the surface ionization rate. The first arises when the dimensions of the enclosure are appreciably larger than those of the tissue mass and is due to back-scattered radiation. The second occurs when the radius of the tissue mass is comparable with the range of the β radiation in tissue and is due to the partial transparency of the tissue mass. Experimental results are given on the magnitude of the ionization due to backscattered radiation when P³² β radiation falls on various materials, and these are used to develop the theory. An experimental test, in which surface ionization rates were determined for tissue phantoms of simple shape in a P³² box of rectangular sides is described. The results are in fair agreement with the theoretical predictions. (auth)

363

A COBALT 60 TELECURIE UNIT. M. Lederman and C. A. Greatorex. *Brit. J. Radiol.* **28**, 525-32(1953) Oct.

The measurement of the dosage distribution of γ radiation from a Co⁶⁰ teletherapy source in a water phantom is described. Isodose curves obtained with new field shapes are presented. Contamination of the unit by Co dust is discussed. (C.H.)

364

LARGE NaI SCINTILLATION COUNTER STUDY OF THE NEUTRON CAPTURE GAMMA RAYS FROM HYDROGEN. Bernard Hamermesh and Richard J. Culp. *Phys. Rev.* **92**, 211(1953) Oct. 1.

Scintillation-counter studies of capture γ rays using a $\frac{3}{8} \times 1\frac{1}{2}$ -in. right cylinder of NaI were hampered because of the Compton electrons formed in the crystal by the higher-energy γ rays. A $3\frac{1}{2} \times 3\frac{1}{2}$ -in. right cylinder of NaI(Tl), used in conjunction with a bundle of three 5819 photomultipliers placed next to one of the flat faces of the crystal, gave resolution comparable to the best small crystals. This, together with the behavior of the crystal in suppressing the effect of the Compton processes, makes the

crystal very useful for capture γ -ray studies. The thermal neutron capture γ -ray spectrum of H obtained with the aid of such a crystal is shown. (L.M.T.)

MESCS VS

365

Rochester Univ.

ON THE SIGNS OF THE PHASE SHIFTS FOR PION-PROTON SCATTERING. S. W. Barnes, C. E. Angell, J. P. Perry, D. Miller, J. Ring, and D. Nelson. Sept. 25, 1953. 5p. Contract AT(30-1)-875. (NYO-3833)

The nuclear phase-shift angles α_1 , α_3 , and α_{33} are evaluated for the reactions $\pi^+ + p \rightarrow \pi^+ + p$, $\pi^- + p \rightarrow \pi^- + p$, and $\pi^- + p \rightarrow \pi^0 + n$, assuming that α_{11} , α_{13} , and α_{31} are negligibly small. The values determined are $\alpha_1 = +9.7 \pm 1.2^\circ$, $\alpha_3 = -2.6 \pm 1.4^\circ$, and $\alpha_{33} = +5.7 \pm 1.2^\circ$. (K.S.)

366

THE TRANSITION EFFECT FOR SLOW MESONS. A. G. Vaisenberg. Translated from *Doklady Akad. Nauk S.S.S.R.* 91, 483-5(1953). 3p. (NSF-tr-93)

A brief abstract of this report appears in *Nuclear Science Abstracts* as NSA 7-6582.

367

ON THE TWO TYPES OF CHARGE INVARIANCE. A. Baldin and V. Mikhailov. Translated from *Doklady Akad. Nauk S.S.S.R.* 91, 479-82(1953). 4p. (NSF-tr-101)

An abstract of this article appears in *Nuclear Science Abstracts* as NSA 7-6584.

368

SPECTRUM OF HYDROGEN MU-MESONS. A. D. Galanin and I. Ya. Pomeranchuk. Translated from *Doklady Akad. Nauk S.S.S.R.* 86, 251-3(1952). 4p. (AEC-tr-1720)

A brief abstract of this report appears in *Nuclear Science Abstracts* as NSA 7-1488.

369

EXAMPLE OF A V^+ DECAY. R. W. Thompson, A. V. Buskirk, C. J. Karzmark, and R. H. Rediker. *Phys. Rev.* 92, 209-10(1953) Oct. 1.

A detailed analysis is presented for a heavily ionizing particle of momentum 270 ± 10 Mev/c which entered a cloud chamber and decayed in flight to produce a secondary of minimum ionization. The estimate of primary mass from ionization and momentum is less uncertain in this case since the proximate meson track of momentum 67 ± 4 Mev/c is heavily ionizing and could be used for comparison. (L.M.T.)

MICROWAVES

370

Electronics Research Lab., Univ. of Calif., Berkeley
COUPLING BETWEEN WAVEGUIDES AND CAVITY RESONATORS FOR LARGE POWER OUTPUT. TECHNICAL REPORT. Series No. 1, Issue 65. Frederick B. Wood. May 1, 1953. 122p. Contracts W-19(122) ac-38 and W-33(038) ac-16649. (AD-10087; Technical Report Series No. 1, Issue No. 65)

Iris coupling between waveguide and cavity resonators is investigated both experimentally and theoretically. Experimental measurements are made of the resonant frequency, input impedance, and loaded Q of a coaxial resonator which is an approximation to the output coupling problem at the anode resonator of several resonatron tubes. It is shown that Bethe's lumped constants for small irises can be extended in special cases to intermediate-size inductive irises. In general, however, for irises of medium or large size, approximate dyadic Green's functions for cavity resonators having finite wall losses are developed by substitution of eigenvalues derived from the theory of perturbation of boundary conditions. The integral equation

for the input admittance of the resonators coupled through an iris to a waveguide is developed by use of the dyadic Green's function. The component admittances are shown to be stationary with respect to first-order variation of the iris field. The transformer ratio of the equivalent circuit obtained from the integral equation is shown to be stationary when both the resonator and the waveguide fields have the same form at the iris. The equation for the coupled Q of a resonator is obtained by inserting values representing a trial iris field in the stationary integrals for the input admittance and then taking the derivative with respect to frequency. This gives the energy stored by the system at zero values of the admittance function. The special case of a rectangular resonator which can be treated as a short-circuited transmission line is solved by use of simplifying assumptions. Results are put in a form useful for quick approximate calculation of the coupled Q and resonant frequency of iris-coupled resonators having a similar field distribution near the iris. The coupled Q and resonant frequency of a coaxial resonator in the TEM₀₀ mode are calculated by use of the rectangular resonator approximation for the complete range of iris sizes covered by the experiments. For large capacitive irises a more detailed calculation is made by direct use of the coaxial resonator Green's functions. (auth)

371

Research Lab. of Electronics, Mass. Inst. of Tech.
QUARTERLY PROGRESS REPORT [FOR THE PERIOD ENDING MAY 31, 1953]. J. B. Wiesner, G. G. Harvey, and H. J. Zimmermann. July 15, 1953. 131p. (NP-4867)

Preliminary investigations are reported on the electron-emission characteristics of W and oxide-coated cathodes. A new circuit design modification is proposed for the control of ion gages. The optical system of a null-indicating infrared pyrometer has been redesigned. The lowest readable temperature was 230°C. A theoretical study of microwave gaseous discharges is given. An experiment on the decay of electron density in H afterglow is described. The variation of thermal conductivity in Mg containing Mn impurities is examined in the temperature ranges near absolute zero. The amplitudes of second-sound pulses in liquid He near 1.4°K are tabulated. New transitions in the microwave spectra of D₂O and HDO have been identified. The nuclear magnetic moments of S³⁵ and Se⁷⁸ have been determined. A high-temperature microwave spectrograph has been used to analyze the absorption spectrum of KCl. The nuclear spin of I has been verified to be $\frac{5}{2}h$, and values of the interaction constants for calculating I hfs are given. Noise and propagation data are given for temperature-limited, pulsed-electron beams. Further refinements have been made in the design and performance of limiting circuits for FM receivers. New experiments are described in the fields of statistical and human communications; together with an approach for electronic speech analysis. A general description of the "cliff" method of approximate integration is presented. Network theory applications are outlined for the generation of RC polynomials and an analysis of a Brune cycle. Analog computer power supply designs and applied network theory are developed. The performance of transistors has been studied in relation to amplifier, multiplier, and receiver design. A theoretical study of transistor noise is presented. (For preceding period see NP-4645.) (K.S.)

MOLECULAR PROPERTIES

372

VIBRATIONAL SPECTRA OF BENZENE AND DEUTERO-BENZENES: COMPUTATION AND INTERPRETATION. M. A. Kovner. Translated from *Doklady Akad. Nauk*

S.S.S.R. 91, 499-502(1953). 4p. (NSF-tr-104)

A large number of vibrational spectrum lines for benzene and the 5 deuterio-benzene derivatives have been calculated by taking into account all types of interactions between all the structural elements of the rings. Good agreement is found with existing data. (K.S.)

NUCLEAR PHYSICS

373

Radiation Lab., Univ. of Calif., Berkeley

1. ISOMERIC STATES OF BISMUTH 210. 2. RELATIVE YIELDS IN THE FORMATION OF NUCLEAR ISOMERS. (thesis). Harris Benjamin Levy. Aug. 1953. 43p. (UCRL-2305)

In Part I, the previous work on a long-lived α -emitting isomeric state of Bi^{210} has been revised and extended. The mass assignment has been confirmed by separation of mass fractions, and the half life of this isomer is not estimated to be $\sim 10^6$ years. The α decay energy was redetermined to be 5.031 ± 0.020 Mev, indicating that the long-lived state of Bi^{210} lies 25 ± 40 kev below RaE. The branch decay of the long-lived state to Po^{210} was determined and found to be about one part in 270. A search resulted in an upper limit of one part in 10^6 being set for the amount of the long-lived state present in U ores relative to the amount of RaE present. A discussion of the relationship of the long-lived state of Bi^{210} to Pb^{210} , RaE, and Po^{210} is presented, showing that a likely designation for the long-lived state is 4-. In Part II, the formation of nuclear isomers in reactions is examined on the basis of results obtained for the isomers of Co^{58} from an (α, n) reaction on Mn^{55} . The results on the Co^{58} isomers prove that the ratio $(2I_m + 1)/(2I_g + 1)$ cannot act as a limiting value for the ratio σ_m/σ_g . A qualitative analysis of the mechanism for the formation of isomers in nuclear reactions is presented. (auth)

374

CONTRIBUTION TO THE THEORETICAL STUDY OF β RADIOACTIVITY AND OF E CAPTURE: INTERVENTION OF THE ELECTRON CORTEGE. P. Benoist-Gueutal. *Ann. phys.* (12) 8, 593-645(1953) July-Aug. (In French)

The precision and the relative ease of operation of the different methods of evaluating the density or atomic electrons -- particularly of the K and L electrons -- in the neighborhood of the nucleus were discussed. The results obtained were compared with the experimental values. The possibility of observing a variation of the period of electron capture as a function of the chemical structure was discussed. The probability of transition by electron capture or β emission from the system, formed by interaction of the nucleus and all its peripheral electrons, was studied by considering the effect of changing the charge of the nucleus on the electrons. The formulas obtained lead, in the case of disintegration by electron capture of the neutral atom of Be^7 in its ground state, to an agreement P_L/P_K between 2.2 and 3.3 times as large as that given by the ordinary theory. The importance of these corrections diminishes when the charge Z of the radioactive nucleus increases. In emission, the presence of the atomic electron leads to a modification of the energetic conditions of the phenomenon and a modification of the maximum energy of the spectra. The form of the β spectra is altered little, at least when the higher limit is sufficiently elevated. The formulas obtained show the probability of excitation or of ionization of the final atom caused by β emission. The probability of the capture of an electron of principle quantum number n diminishes when n diminishes and Z increases. (tr-auth)

375

STUDY OF THE COINCIDENCES OF HEAVY PARTICLES-GAMMA RAYS; EXPERIMENTAL STUDY OF THE ANGULAR

CORRELATIONS OF HEAVY PARTICLES-GAMMA RAYS; THEORETICAL STUDY OF THESE CORRELATIONS; DETERMINATION BY THIS METHOD OF THE SPIN OF SOME EXCITED LEVELS OF LIGHT NUCLEI. J. Thirion. *Ann. phys.* (12) 8, 489-534(1953) July-Aug. (In French)

It is shown that the determination of the spins of the first excited level of light nuclei is essential to the expansion of the knowledge of nuclear forces. From the spins the degree of probability of different nuclear reactions can be determined and the values of the spin-orbit force deduced. The determination of the angular correlations of heavy particles- γ rays is a general method for the determination of the values of the nuclear spin. The applications developed permits some conclusions concerning the Li^7 and Be^7 doublet. The first excited level of O^{17} has, probably, a spin of $1/2$. From this value the levels in the shell model corresponding to quantum number, $n = 2$, can be classified. The level $\text{S}_{1/2}$ would be placed lower than the level $\text{d}_{3/2}$. The spin of the excited level of 4.9 Mev of Be^8 probably has a value of 1. Some spins of levels of Be^9 were found, and the value of the orbital moment which emits the neutron corresponding to the γ emission in the transmutation $\text{Li}^7(d, n)\text{Be}^8$ was deduced. (J.S.R.)

376

THE INTERACTION WITH MOLECULAR ROTATION OF THE NUCLEAR ELECTRIC QUADRUPOLE MOMENTS OF TWO NUCLEI HAVING SPINS $3/2$. G. Wilse Robinson and C. D. Cornwell. *J. Chem. Phys.* 21, 1436-42(1953) Sept.

The theory of nuclear electric quadrupole effects in molecules is applied to the particular case of a molecule containing two nuclei each having spin $3/2$. The matrix elements of the first-order Hamiltonian of interaction between the nuclear electric quadrupole moments and the molecular rotational angular momentum are determined in the $I_1 I_2 J F M_F$ representation. In one particular case the secular equations may be solved explicitly for the energy levels in terms of J, and the general solutions as well as their numerical values for $J \leq 12$ are given. For the other cases, higher-order secular equations must be solved, and to facilitate this, coefficients in the expanded secular determinants have been computed. The method for obtaining relative line strengths for transitions is described, and numerical values of these are given for some transitions. Applications to the analysis of rotational spectra are also discussed. (auth)

NUCLEAR PROPERTIES

377

Argonne National Lab.

THE SLOW NEUTRON CAPTURE CROSS SECTION OF CARBON¹³. G. R. Hennig. Aug. 14, 1953. Decl. Oct. 20, 1953. 16p. (AECD-3593; ANL-OCS-374)

The cross section of C for the (n, γ) reaction was determined by using samples of graphite, BaCO_3 , and CO_2 . The results were consistent only when samples were used which were enriched in C^{13} . The average isotopic cross section determined for the enriched samples was 1.37 ± 0.2 mb. The residual N in the BaCO_3 samples was estimated at 9 ppm by weight. The final value of the cross section on these samples corrected for this N is 0.9 ± 0.2 mb. (auth)

378

Los Alamos Scientific Lab.

TOTAL NEUTRON CROSS SECTION FOR URANIUM FROM 20 KEV TO 20 MEV. R. H. Henkel, L. Cranberg, G. A. Jarvis, R. Nobles, and J. E. Perry. [1953] Decl. Nov. 2, 1953. 11p. (AECD-3598)

The total neutron cross section of normal U was measured for neutron energies from 20 kev to 7.6 Mev and at 17, 19, and 20 Mev. When combined with other published

work in the 7- to 14-Mev range, the result is a smooth cross section curve up to 20 Mev. The curve fits smoothly on the surface showing total neutron cross section as a function of both atomic weight and neutron energy. (auth)

379

Radiation Lab., Univ. of Calif., Berkeley
TOTAL CROSS SECTION FOR POSITIVE PIONS IN HYDROGEN. Stanley L. Leonard and Donald H. Stork. Aug. 27, 1953. 24p. Contract W-7405-eng-48. (UCRL-2314)

The total cross section for positive pions in H_2 has been measured at pion kinetic energies of 33, 44, 56, and 70 Mev. The attenuation of pions of these energies in liquid H_2 was studied by scintillation-counter techniques. The geometry was such that pions scattered at angles greater than $\pm 35^\circ$ were counted as having been removed from the beam. Therefore, the term "total cross section" is taken to mean the cross section for all interactions except those in which the pion is scattered into an angle of less than $\pm 35^\circ$ from the pion beam direction. The results are

Pion Energy (Mev)	Cross Section (mb)
33 \pm 4.5	6.4 \pm 2.1
44 \pm 4	9.8 \pm 1.5
56 \pm 4	17.6 \pm 2.2
70 \pm 5	19.0 \pm 2.6

The energy dependence of the cross section seems to agree with the predictions of lowest-order perturbation theory for pseudoscalar mesons with gradient coupling to the nucleon. (auth)

380

THE NUCLEAR STABILITY CURVE. W. G. McMillan. *Phys. Rev.* 92, 210-11(1953) Oct. 1.

In the usual explanation of the relation between mass number A and atomic number Z for stable nuclei, the minimizing condition $(\partial E / \partial Z)_A = 0$ applied to a semi-empirical expression for the total nuclear energy $E(Z, A)$ yields the stability relation $Z = A / (2 + 0.0146 A^{2/3})$, which is known to be in good agreement with observation. It is shown that a relation of this form results from the Fermi-Dirac degenerate-gas model on the assumption that nucleon interactions are, apart from ordinary Coulomb forces, independent of charge state. (auth)

381

LOW-LYING MANY-PARTICLE LEVELS IN ODD MASS NUCLIDES WITH 21, 23, 25, or 27 PROTONS OR NEUTRONS. R. H. Nussbaum, R. van Lieshout, and A. H. Wapstra. *Phys. Rev.* 92, 207-8(1953) Oct. 1.

A search was made for low-energy (< 1.0 -Mev) excited states in V^{49} , V^{51} , Ca^{43} , Mn^{53} , Sc^{45} , Cr^{51} , and A^{39} . These results are presented along with other data for odd-mass nuclei with 23 and 25 neutrons or protons. The preliminary conclusions derived from an analysis of the available nuclear energy levels in this region are given. (L.M.T.)

382

ANGULAR CORRELATION BETWEEN THE FIRST AND THIRD GAMMA RAYS IN Ti^{48} . C. E. Whittle and P. S. Jastram. *Phys. Rev.* 92, 205-6(1953) Oct. 1.

The angular correlation function between the 1.05- and 0.99-Mev γ rays of Ti^{48} was measured with NaI(Tl) scintillators and differential pulse-height selectors used in order to accept only pulses in the 1-Mev peak. A plot shows the coincidence rate as a function of angle, and the data are in agreement with the distribution which holds when all three γ rays are quadrupole and for spin assignments 0-2-4-6 for the ground state and first three excited states. The same distribution is predicted for any order of the γ rays,

hence the first and third γ -ray correlation does not determine the order of emission. On the basis of the polarization-direction correlation between the 0.99- and 1.32-Mev photons (results to be published), even parity is assigned to the first two excited levels of Ti^{48} . A decay scheme for Sc^{46} , consistent with all evidence reported to date, is presented. (L.M.T.)

383

POLARIZATION OF NUCLEAR SPINS IN METALS. T. R. Carver and C. P. Slichter. *Phys. Rev.* 92, 212-13(1953) Oct. 1.

Overhauser (*Phys. Rev.* 89, 689(1953); 91, 476(1953)) has predicted that for metals the saturation of the conduction electrons should simultaneously increase the population difference between the nuclear Zeeman levels by a factor of several thousand. Since the strength of the nuclear resonance absorption is proportional to the population difference between adjacent nuclear Zeeman levels, the nuclear resonance forms a convenient method of measuring the degree of nuclear alignment. An experiment is described in which the enhancement of the nuclear resonance in metallic Li by electron saturation was observed. The nuclear population difference was increased only about 100-fold, showing that either complete saturation was not achieved or that other nuclear relaxation processes partially short circuit the alignment. (L.M.T.)

384

A NEW DETERMINATION OF THE HALF-LIFE OF Am^{242m} ; THE PROBLEM OF COUNTING SHORT-LIVED ACTIVITIES. Thomas K. Keenan, Robert A. Penneman, and B. B. McInteer. *J. Chem. Phys.* 21, 1802-3(1953) Oct.

The half life of Am^{242m} has been redetermined to yield a value of 16.01 ± 0.02 hr (99% confidence level). A simple relationship is developed between experimentally measured average counts/minute and true dN/dt ; a convenient rule of thumb states that there is $< 0.1\%$ error between average disintegration rate (finite counting interval) when the counting interval does not exceed 20% of the half life. (auth)

385

STUDY BY γ RAYS AND X RAYS OF THE EXCITED LEVELS OF WEAK ENERGY IN SOME HEAVY NUCLEI. Michel Riou. *Ann. phys.* (12) 8, 535-92(1953) July-Aug. (In French)

The excited levels of weak energy were studied by the absorption of x and γ rays during the disintegrations of Th^{230} , Th^{228} , Po^{210} , Pa^{231} , Ra^{228} , Ac^{227} , and Fr^{223} . The first excited level of the even-even nuclei formed by the disintegration of Th^{230} , Th^{228} , and Po^{210} has an angular momentum of 2 and the same parity as the ground state. The value of the angular momentum exposed a disagreement between the theory of α emission and the experimental results upon the fine α structure. The term $\sqrt{z-2} \sqrt{r[1-0.001j(j+1)]}$ of Gamow caused the disagreement between the experimental and theoretical values. The complexity of the disintegration of Pa^{231} precludes precise conclusions. An excited level of 30 kev in the disintegration of Ra^{228} and of 38 kev in the disintegration of Ac^{227} was found. (J.S.R.)

NUCLEAR REACTORS

385

Hanford Works
PRINCIPLES AND PHILOSOPHY OF REACTOR CONTROL CIRCUITS. Ivan M. A. Garcia. [nd] Decl. Aug. 27, 1953. 32p. (AECD-3591; HW-28705(rev.))

This paper gives an insight into some of the principles, problems, and philosophy that the engineer considers in the basic design of reactor electrical circuits with typical examples of control and safety circuits. Among the

components discussed are sensing circuits, interlocks, bypass schemes, indications, and power supplies. Design principles which enable the engineer to evaluate the fundamental correctness of reactor circuits are: the principle of duality with two channels for each function; the fail-safe principle that guards against misoperations due to personnel and equipment failures; the sequential principle that regulates the bringing of the reactor to power level and its shutdown sequence; and the principle of reliability for both circuits and equipment. The closing discussion covers practical design limits and how the engineer copes with the problems involving some of the variables of control circuit design. (auth)

387

Knolls Atomic Power Lab.

MULTIGROUP METHODS FOR NEUTRON DIFFUSION PROBLEMS. H. Hurwitz, Jr. and R. Ehrlich. [nd] Decl. Sept. 10, 1953. 44p. (AECD-3595)

The age-diffusion equation is adequate to describe the neutron behavior of a very large class of nonthermal reactors (all except those whose dimensions are comparable to the neutron mean free path). Thus, a convenient means of obtaining an accurate solution to this equation is very useful for general reactor calculations. Methods for reducing the age-diffusion equation to a finite set of coupled ordinary differential equations, called multigroup equations, are described. The relative merits of several alternate schemes are discussed. The multigroup equations may be solved by iterative procedures based on an assumed spatial distribution of the fission-source neutrons. In practice, the initially assumed source shape is accurate enough so that additional iterations are unnecessary. Analytical and numerical methods for solving the multigroup equations with the assumed source are discussed. The adjoint equations are also reduced to multigroup form, and examples of the use of the adjoint function in obtaining improved reactivity values are given. (auth)

388

Phillips Petroleum Co., Atomic Energy Div.

THE MATERIALS TESTING REACTOR DESIGN. John R. Huffman. Oct. 1, 1953. 31p. Contract AT(10-1)-205. (IDO-16121)

The Materials Testing Reactor, which has been under design and construction since 1945, is now in operation at the National Reactor Testing Station near Idaho Falls, Idaho. It is an enriched reactor, reflected with Be. It operates at the highest thermal flux of any known reactor. Experiments which will use many of the approximately 100 available locations are already being inserted or are in the final stages of design. (auth)

NUCLEAR TRANSFORMATION

389

SYSTEMATICS OF PHOTONEUTRON REACTIONS.

R. Nathans and J. Halpern. *Phys. Rev.* **92**, 207(1953) Oct. 1.

Results are presented from a measure of photoneutron yields from 13 elements when irradiated with betatron bremsstrahlung at energies from threshold to 24 Mev. Four enriched BF_3 proportional counters were placed symmetrically 13.5 cm from the target in a paraffin house, and neutron yields were taken at 0.5-Mev intervals to a statistical accuracy of $\sim 1\%$. The least-squares straight line through the experimental points of a log-log plot of $E\sigma_m$ against mass number yields $E\sigma_m = 38.5 A^{-0.19}$, in good agreement with theoretical predictions. A plot of dipole-resonance half widths against neutron number shows a slow decrease in half width as N increases, with the ex-

ception of 4 elements having unusually narrow resonances. (L.M.T.)

PARTICLE ACCELERATORS

390

Los Alamos Scientific Lab.

SOME EXPERIMENTAL FINDINGS AND OPERATING PRACTICES IN BETATRON RADIOGRAPHY AT LOS ALAMOS. Norman C. Miller and John D. Steely. Oct. 9, 1953. 28p. (AECU-2721)

The 3.5-yr history of a 22-Mev fixed beam betatron installation is summarized. Periodic maintenance procedures are outlined, time losses due to breakdown are tabulated, and practical methods of beam alignment and focal spot correction are described. Typical applications are illustrated and discussed, such as radiography of thick steel sections and other common materials, use of the high subject latitude inherent in the 22-Mev radiation, direct magnification during radiography, and methods of stereoradiography. Some of the experiments which have been performed are described briefly. They concern the use of shaped compensators to obtain uniform beam intensity distribution within a prescribed angle, the usefulness of a vacuum type cassette, a comparison between radiographic and photographic enlargement, and optimum intensifying screen thicknesses under various conditions. Lead screen combinations ranging from 0.10 to 0.120-in. front and 0 to 0.040-in. back are evaluated. (auth)

391

OPTICS OF SMALL NUCLEAR PARTICLES ON THE ELIMINATION OF THE EFFECTS OF IMPERFECTIONS OF THE ALIGNMENT OF THE BEVATRON CONVERGING RAPIDLY. M. Joseph Seiden. Translated from *Compt. rend.* **236**, 1145-6(1953). 2p. (AEC-tr-1692)

An abstract of this report appears in *Nuclear Science Abstracts* as NSA 7-2891.

392

NUCLEAR REACTIONS BETWEEN HEAVY NUCLEI.

Willard H. Bennett. *Rev. Sci. Instr.* **24**, 915-16(1953) Oct.

A method is proposed for using a modified Van de Graaff machine for producing nuclear interactions between heavy nuclei. Negative ions are accelerated from ground to a stripping material in the high-potential part of the machine where many electrons are stripped from the ions and re-accelerated towards the target material in a grounded end of the machine. (auth)

RADIATION ABSORPTION AND SCATTERING

393

Research Foundation, Ohio State Univ.

THE STOPPING POWERS OF VARIOUS ELEMENTS FOR PROTONS OF ENERGIES FROM 400 TO 1050 KEV. Arthur B. Chilton, John N. Cooper, and James C. Harris. [1953] 28p. (AECU-2702)

The proton-stopping powers of the elements N, Ne, A, Kr, Xe, Ni, and Cu are reported in the energy range from 400 to 1050 kev. Comparisons are made with results of other experimental work and with theory. The measured stopping powers show a dependence on particle velocity and on the atomic number of the stopping element in general conformity with the theory of N. Bohr. For proton energies below 700 kev, the ratio of atomic stopping power to $Z^{1/2}$ for Ni and Cu is lower than the corresponding ratio for the gases. Energy-loss straggling is reported for Ni and Cu and is of the same order of magnitude as theory predicts. (auth)

394

Los Alamos Scientific Lab.

ELASTIC SCATTERING OF PROTONS BY DEUTERONS AT

HIGH ENERGY. J. L. Gammel. [1953] 34p. Contract W-7405-eng-36. (AECU-2733)

The "phase shifts" which appear in an analysis of high-energy n-d or p-d scattering must be complex numbers, since inelastic scattering also occurs. A modification of Born's approximation is presented which takes account of the effect of the inelastic scattering on the elastic scattering. From it, complex phase shifts are derived which satisfy requirements imposed on them by the condition that particles be conserved. These are used as a starting point for a phase-shift analysis of the 95-Mev p-d experimental data. Since the phase shifts are allowed to be complex, it is possible to analyze the elastic scattering data and the total cross section data simultaneously (however, no attempt is made to analyze the angular or energy distributions of inelastically scattered particles). Satisfactory fits to the angular distribution for elastic scattering and the total scattering cross section are obtained by adjusting the S complex phase shifts, by changing the complex P phase shifts slightly from their Born approximation values, and by using phase shifts calculated in Born approximation for $l \geq 2$. While it is not necessary to use the complex phase shifts for $l \geq 2$ calculated from the modified Born approximation (it is sufficient to use real phase shifts calculated from the usual Born approximation), they do provide slightly better fits to the angular distribution for elastic scattering, and, more important, the contribution to the total cross section for $l \geq 2$ is sufficiently large to require them. Central forces are used for the calculation. It is assumed that the effects of noncentral forces are reproduced by the same "equivalent" central potential which reproduces their effects in high energy n-p and p-p scattering. (auth)

395

Nuclear Development Associates, Inc.

NOTES ON THE TRANSFORMATION FROM SPHERE TO PLANE ISOTROPIC SOURCE. Herbert Goldstein. Sept. 23, 1953. 21p. [Contract W-7405-eng-26], Subcontract 394. (NDA-Memo-12-5)

The conditions are examined under which a well-known relation can be stated between the dose from a spherical source and that from a plane isotropic source whose intensity is the same as the emission from the sphere in the radial direction. On the basis of a homogeneous core and surrounding medium, a mathematical justification is given of the usual physical argument for this relation where the core is "opaque." The case of purely radial emission is discussed as an example in which the relation does not hold. To examine the transition from isotropic to radial emission, correction factors for two types of anisotropic distributions are discussed. It is shown how in principle the correction factor for any given angular distribution can be simply obtained by expanding in Legendre polynomials. It is also suggested that in certain cases total leakage may be a more useful measure of source strength than the radial leakage. Finally, the method of calculating the dose at great distances by using the angular distribution of particles emitted from the core is illustrated with a uniform spherical volume source. (auth)

396

Nuclear Development Associates, Inc.

SOME REMARKS ON PLANE CONICAL SOURCES. J. Certaine. Aug. 3, 1953. 6p. Contract AT(30-1)-862. (NDA-MEMO-15C-13)

The unscattered and first-scattered beams for a monoenergetic plane conical source are given. These are used to determine the source term for the integral equation for the moments of the scattered flux. (auth)

397

Nuclear Development Associates, Inc.

ANGULAR DISTRIBUTION OF PHOTONS FROM PLANE

MONOENERGETIC SOURCES. J. Certaine. June 1, 1953. 51p. Contract AT(30-1)862. (NYO-3074; NDA-15C-10)

The angular distributions of photons arising from plane sources, both isotropic and monodirectional, are derived. The polynomial method described by Spencer and Fano (J. Research Nat. Bur. Standards 46, No. 5 (1951)) is used to reconstruct the total scattered flux which is a ternary function $F(x, \lambda, \omega)$, where x is measured perpendicular to the source plane, λ is the wavelength in Compton units, and $\omega = \hat{x} \cdot \hat{\Omega}$, $\hat{\Omega}$ being a unit vector describing the direction of the beam. It is assumed that the unscattered flux has been removed from the total beam. (auth)

398

Carnegie Inst. of Tech.

PROTON-PROTON SCATTERING AT 437 MEV. William E. Mott. May 23, 1953. 65p. Contract AT(30-1)-882. (NYO-3657)

The differential cross section for the elastic scattering of 437-Mev protons by protons has been measured from 25.2 to 90° in the center-of-mass coordinate system. The source of high-energy protons was the external beam of the Carnegie Inst. of Tech. synchrocyclotron. A coincidence technique was used to detect the scattered and recoil protons emerging from a polyethylene target, and the cross sections were obtained by taking polyethylene-carbon differences. The results indicate a definite deviation from isotropy in contrast to the investigations in the energy range 100 to 345 Mev which suggested an isotropic cross section over the same angular region. (auth)

399

THE ANGULAR DISTRIBUTION OF PHOTONS FROM THE ANNIHILATION OF ELECTRONS; EXPERIMENTAL STUDY. Georges Ambrosino, Jean Houbaut, and Paul Maignan. Compt. rend. 237, 708-9(1953) Oct. 5. (In French)

Scintillation detectors were used to obtain measurements of the annihilation radiation from Cu, CuO, and CuSO₄ sources. The average value of the momentum of the center of mass of the electrons at the moment of their annihilation was found to be 8.4×10^{-3} mc for Cu, 8.5×10^{-3} mc for CuO, and 9.6×10^{-3} mc for CuSO₄. (J.S.R.)

400

PHASE-SHIFT ANALYSIS OF HIGH-ENERGY p-p SCATTERING EXPERIMENTS. A. Garren. Phys. Rev. 92, 213-14(1953) Oct. 1.

It has often been suggested that the isotropy of the differential cross section for p-p scattering up to 350 Mev, as well as its magnitude, might be fitted with s and p waves only. Wolfenstein and Ashkin (private communication) proposed including in such an analysis the left-right asymmetry, observed at Rochester, of $2e = 9.8 \pm 5\%$ in the final angular distribution of 240-Mev protons scattered successively by two (effective) H₂ targets. It is shown that such a fit can be made for the 240-Mev data with a number of different combinations of phase shifts. (auth)

RADIATION EFFECTS

401

Tracerlab, Inc.

CHEMICAL SYSTEMS SENSITIVE TO RADIATION. MONTHLY REPORT [FOR] DECEMBER 1951. [Melvin Fields] Dec. 31, 1951. 19p. (ATT-150188; Monthly Report 6)

402

PHOTOIONIZATION OF EXCITED MERCURY ATOMS. B. M. Yavorskii. Translated from Zhur. Eksptl'. i Teoret. Fiz. 23, 126-7(1952). 5p. (AEC-tr-1724)

403

INFLUENCE OF IRRADIATION ON DISCHARGE CURRENT

IN AN OZONIZER. S. Deb, A. K. Saha, and M. Ghosh. *J. Chem. Phys.* **21**, 1486-92(1953) Sept.

The principal characteristics of the effects of irradiation on the discharge current in an ozonizer are outlined. The "electronic surface charge theory" of the effect developed by Deb and Ghosh, on a suggestion of Mitra, is explained and is further extended by taking into account the role played by the negative ions formed in the discharge space. It is assumed that the effect of irradiation is to decrease the charges deposited on the surface and to increase those in the volume. The former reduces the discharge current due to the neutralization of the surface charges, and the latter increases the main discharge current due to the applied voltage. The net effect is generally a decrease if conditions are favorable for the capture of the electrons in the volume by neutral gas molecules, leading to the formation of negative ions. In all other conditions the effect is generally an increase. It is shown that the theory, in its extended form, is able to account for the origin and the characteristics of both the positive and the negative effects. Numerical calculations of the various rate processes involved in the proposed mechanism are also made. It is shown that the relative magnitudes of these processes are such as to support strongly the "electronic surface charge theory" of the effect. (auth)

404

ACTION OF THE β RAYS OF Ti^{204} AND Sr^{90} UPON ORDINARY PHOTOGRAPHIC FILMS. Ouang Te-Tchao and Eliane Montel. *Compt. rend.* **237**, 800-2(1953) Oct. 12. (In French)

The effect of β radiation on two series of film, one with a sensitivity of 33° Scheiner and the other much more sensitive, was determined. The less sensitive film showed no modifications produced by radiation; the more sensitive film was lightly marked. It was concluded that the absorption of β rays can be used to control the thickness of emulsion of photographic film. (J.S.R.)

RADIOACTIVITY

405

Los Alamos Scientific Lab.
NOTE ON THE TRIPLE GAMMA RAY CASCADE IN Sb^{124} . L. M. Langer and J. W. Starnes. [1953] 3p. (AECU-2714)

Three-fold coincidences were studied by means of three NaI crystals equally spaced about a Sb^{124} source which was imbedded in a 2-in.-diam. cylinder of lucite. The scintillations were detected by Dumont K1186 photomultipliers and fed into a 0.2- μ sec resolving-time coincidence selector which accepted only those pulses in each channel whose height lay between bounds of 0.55 and 0.76 Mev. The results obtained are consistent with the recent proposal of a 0.64-, 0.72-, and 0.603-Mev γ cascade. (L.M.T.)

406

Oak Ridge National Lab.
MEASUREMENT OF ACTIVITY AND ISOTOPIC ABUNDANCE OF CARBON-14 IN BARIUM CARBONATE. S. A. Reynolds and E. I. Wyatt. Oct. 16, 1953. 6p. (CF-53-10-104)

The activity of C^{14} in CO_2 was measured in a calibrated ionization chamber and electrometer after evolving the CO_2 from aqueous carbonate solution. A new factor (321 instead of 282 now being used) was determined for use in calculation of the isotopic percentage of C^{14} . A half-life value of ~ 5800 yr was obtained. (L.M.T.)

407

Oak Ridge National Lab.
THE BETA-DECAY INTERACTION AND THE ANALYSIS OF RECOIL EXPERIMENTS. M. E. Rose. Issued Oct. 19, 1953. 24p. (ORNL-1593)

The present status of the theory of β -decay is reviewed with special emphasis on the question of the nature of the β -interaction. The role of recoil and angular correlation experiments, for the purpose of determining the nature of the Fermi interaction, is discussed. With the case of the $0 \rightarrow 0$ transition of O^{14} in mind, the calculations of the momentum recoil spectrum and the angular correlation function are carried out for this transition, taking into account the recoil due to the γ ray which follows the β emission. In view of possible intensity difficulties in the O^{14} decay the angular correlation (no γ ray) in A^{35} and Cl^{34} is also discussed. (auth)

408

Radiation Lab., Univ. of Calif., Berkeley
ORBITAL ELECTRON CAPTURE IN THE HEAVIEST ELEMENTS (thesis). Richard William Hoff. Sept. 1953. 88p. Contract W-7405-eng-48. (UCRL-2325)

Certain isotopes in the region of the heaviest elements have been produced by cyclotron- and pile-bombardment techniques, and their nuclear decay properties have been investigated. The orbital electron-capture decay of At^{210} , At^{211} , Np^{234} , Np^{235} , Pu^{234} , Pu^{237} , and Am^{242m} was studied, and decay schemes are proposed. In addition, the α spectra of Po^{211} , At^{210} , and At^{211} were observed. The decay energy, as determined from closed decay cycles and the proposed decay scheme, and the observed half life for the electron capture of the experimentally studied nuclides are correlated with β -decay theory for allowed and forbidden transitions. Certain other known electron-capture nuclides in the heaviest elements where decay energies may also be calculated from closed decay cycles are treated in a similar manner. The observed K/L electron-capture ratios showed agreement with theoretically predicted values in most cases. A logarithmic plot of the electron-capture partial half life vs. neutrino energy was made for both the allowed and first-forbidden species. Approximate agreement was shown between the observed slope and the slope predicted by electron-capture theory for a straight line drawn through the points for each type of transition. (auth)

409

THE SEQUENCE OF γ EMISSION IN TRIPLE CORRELATIONS. E. J. Hellund and J. M. Jauch. *Phys. Rev.* **92**, 203(1953) Oct. 1.

Biedenharn, Arfken, and Rose (Phys. Rev. **83**, 586(1951)) discussed an example of a triple correlation in which the sequence of the last two γ 's is not determined by the correlation function, namely, $B^{11}(p, \gamma_1\gamma_2)$, the last two γ 's being emitted according to the scheme (2D1D0). A proof is presented of the theorem that the same ambiguity is present in the more general γ cascade $[j_0(2^{L_0}\text{pole})]_a(2^{L_1}\text{pole})L(2^{L_2}\text{pole})0$. The spins of the levels are $(j_0, j_a, L, 0)$, and the symbol 2^{L_0} denotes the multiple order of the emitted radiation. The same conclusion holds if, in the place of the 2^{L_0} pole emission, concern is made with a particle capture followed by the emission of 2 gammas as in the triple γ cascade. (auth)

410

THE TOTAL DISINTEGRATION ENERGY OF P^{29} . Hilliard Roderick and Calvin Wong. *Phys. Rev.* **92**, 204(1953) Oct. 1.

P^{29} was produced in the $Si^{28}(d,n)$ reaction by bombarding a 4.5 mg/cm² quartz target in the focal plane of a lens-type β spectrometer with deuterons from a 3-Mev electrostatic generator. Normalization was based on the fact that a given amount of bombardment charge produced a given total number of positrons; the charge was measured with a conventional beam integrator. The following results were obtained: a disintegration energy of P^{29} of 4.967 ± 0.010 Mev; the

ground state Q of the $\text{Si}^{28}(\text{d}, \text{n})\text{P}^{29}$ reaction of $+ 0.497 \pm 0.013$ Mev; mass of P^{29} of 28.990984 ± 36 amu; and log ft values of the P^{29} positron transitions to the ground state, the 1.28-Mev level, and the 2.43-Mev level of Si^{29} of 3.73 ± 0.03 , 4.7 ± 0.3 , and 4.4 ± 0.3 , respectively. (L.M.T.)

411

THE DECAY OF Ta^{183} . J. W. M. DuMond, H. C. Hoyt, P. E. Marmier, and J. J. Murray. *Phys. Rev.* **92**, 202(1953) Oct. 1.

After irradiating Ta in the MTR, 21 γ lines were found associated with a (5.2 ± 0.1) -day half life. This half life is ascribed to Ta^{183} , formed by successive neutron captures in Ta^{181} . The wavelengths, energies, and relative intensities of the γ lines are listed, and the associated β^- spectrum has an end point at 558 ± 10 kev. No decay scheme will be presented until further investigations are made. (L.M.T.)

RARE EARTHS AND RARE-EARTH COMPOUNDS

412

RADIOCRYSTALLOGRAPHIC STUDY OF THE PROGRESSIVE HYDROGENATION OF LANTHANUM. Bertrand Dreyfus-Alain and Rodolphe Viillard. *Compt. rend.* **237**, 806-8(1953) Oct. 12. (In French)

The progressive hydrogenation of La was obtained at a temperature of 300°C and at very reduced pressures. At the low pressures used there existed a network of face-centered cubes of La with the parameter $a = 5292$ Å. A hydride phase, also face-centered cubic, coexisted with the metal. The hydride parameters varied from 5650 Å at 0.01 mm Hg to 5662 Å at 2.2 mm Hg. Between a pressure 2.2 and 2.9 mm Hg the hydride parameter changes abruptly and at 2.9 mm stabilizes itself at 5695 Å. (J.S.R.)

SHIELDING

413

CONCRETE FOR RADIATION SHIELDING. Edwin J. Callan. *J. Am. Concrete Inst.* **25**, 17-44(1953) Sept.

Concrete for shielding nuclear radiation is discussed, with emphasis on factors related to concrete technology and cost. The types of radiation and mechanics of radiation shielding are presented briefly, and data regarding concrete for shielding are reviewed. Tables and curves of concrete thickness required for shielding are given for both ordinary and heavy concrete. Problems involved in the use special concrete are discussed. An outline of a procedure for designing concrete shielding is presented. (auth)

SPECTROSCOPY

414

Ballistic Research Labs., Aberdeen Proving Ground INVESTIGATIONS CONCERNING SOME APPLICATIONS OF MICROWAVE SPECTROSCOPY. B. L. Hicks, T. E. Turner, W. M. Kendrick, and Verna C. Fiora. Aug. 1953. 23p. (BRL-Memo-703)

Some research in the field of microwave spectroscopy which is of interest in the study of interior ballistics is described. Some theoretical investigations are mentioned; three of these, the hfs of the Hg methyl chloride spectrum, the pressure broadening of spectral lines, and the spectrum of the OH radical, are mentioned very briefly, while a fourth, collision phenomena, is discussed in some detail. The feasibility of using the microwave spectrometer as a tool in making chemical analyses was investigated by working on a problem which is considered typical, namely, the identification of the decomposition products of nitrocellulose. Investigations of the microwave spectra and structure of two asymmetric molecules, ethylenimine and nitromethane,

and some of the related computational work done with the aid of the EDVAC and ORDVAC are described. (auth)

415

Duke Univ.

RADIOFREQUENCY SPECTROSCOPY. PROGRESS REPORT NO. 5, MAY 1, 1953-AUGUST 1, 1953. 54p. Contract DA-36-034-ORD-1233. (NP-4876)

Separate abstracts have been prepared for the two sections of this report.

416

Duke Univ.

TEMPERATURE DEPENDENCE OF THE NUCLEAR SUSCEPTIBILITY OF He^3 BETWEEN 1.2°K AND 4.2°K . W. M. Fairbank, W. B. Ard, H. G. Dehmelt, Walter Gordy, and S. R. Williams. Bound in RADIOFREQUENCY SPECTROSCOPY. PROGRESS REPORT NO. 5, MAY 1, 1953-AUGUST 1, 1953. 6p. Contract DA-36-034-ORD-1233. (NP-4876(Special Report No. 1))

The temperature dependence of the nuclear susceptibility of He^3 was measured directly by observing the strength of the nuclear magnetic resonance absorption signal in He^3 gas at 4.2°K and 900 mm pressure and in the liquid from 2.8 to 1.2°K . From the results it is seen that the nuclear susceptibility of liquid He^3 follows a $1/T$ law down to the lowest temperature reached. (auth)

417

Duke Univ.

NUCLEAR QUADRUPOLE RESONANCE. H. G. Dehmelt. Bound in RADIOFREQUENCY SPECTROSCOPY. PROGRESS REPORT NO. 5, MAY 1, 1953-AUGUST 1, 1953. 41p. Contract DA-36-034-ORD-1233. (NP-4876(Special Report No. 2))

The basic theory and experimental techniques employed in nuclear quadrupole resonance studies are reviewed, and comparison is made with nuclear magnetic resonance. The various nuclei which have been investigated by means of this technique are listed, along with the results obtained. (L.M.T.)

418

Aircraft Radiation Lab., Wright Air Development Center SPECTRAL INTENSITY CALIBRATION OF INFRARED SPECTROMETERS. Josef Kaspar. Apr. 1952. 32p. (WADC-TR-52-58; AD-2171)

419

P-Spectroscopy

REFLECTION SPECTRA OF ORDINARY AND DEVITRIFIED LEAD GLASSES IN THE INFRARED. V. A. Florinskaya. Translated from Doklady Akad. Nauk S.S.S.R. **89**, 261-4(1953). 5p. (NSF-tr-50)

The reflection spectra of ordinary and devitrified Pb glasses in the infrared were compared. The absorption bands of the two kinds of glasses were remarkably similar. The reflection bands were displaced toward longer wavelengths as the PbO content was increased from 21 to 71%. The agreement in the spectra of the ordinary PbO glass and the devitrified PbO showed that the characteristic bands of the chemical compounds were inherent in the glass and that the glasses must contain crystallites of the compounds which grow into visible crystals in the devitrified glass. The simplest reflection curves were observed in glass with the composition of Pb orthosilicate. (J.S.R.)

420

ON THE THEORY OF THE COMPOUND ETALON

(MULTIPLEX). F. A. Korolev. Translated from Doklady Akad. Nauk S.S.S.R. **88**, 651-2(1953). 2p. (NSF-tr-49)

In order to study the hyperfine structure of a spectral line, a compound etalon-multiplex, made of two etalons placed one behind the other, is often used. The dispersal power of such an etalon is calculated. (J.S.R.)

421

THE USE OF THE ACTION COEFFICIENTS FOR THE STUDY OF THE VIBRATIONAL SPECTRA OF POLY-ATOMIC MOLECULES. II. THE ACTION COEFFICIENTS, FREQUENCIES, FORM OF VIBRATIONS, DISTRIBUTION OF FORCES AND AN ANALYSIS OF THE CHARACTER OF THE INTERACTION OF FREQUENCIES FOR ACETYLENE AND DEUTEROACETYLENES. P. G. Maslov and S. A. Antipina. Translated by E. Rabkin from *Zhur. Eksptl'. i Teoret. Fiz.* 22, 172-83(1952). 29p. (TT-373)

422

THE USE OF AN ALUMINUM WEDGE FOR QUANTITATIVE ANALYSIS WITH THE AID OF A CURVED CRYSTAL X-RAY SPECTROGRAPH. I. G. Dem'yanikov. Translated from *Izvest. Akad. Nauk S.S.S.R. Ser. Fiz.* 15, 239-42 (1951). 6p. (AEC-tr-1657; AEC-tr-1191; W.O.-22857)

A brief abstract of this report appears in *Nuclear Science Abstracts* as NSA 5-7019.

THEORETICAL PHYSICS

423

Maryland Univ.
GREEN'S FUNCTIONS IN QUANTUM ELECTRODYNAMICS. James L. Anderson, Univ. of Maryland and Rutgers Univ. [1953] 28p. Contract Nonr-594(00). (NP-4919)

424

QUANTUM FIELD THEORY OF BOUND STATES. IV. RELATIVISTIC THEORY OF THE EXCITED STATES OF HYDROGEN. R. J. Eden. *Proc. Roy. Soc. (London)* A219, 516-26(1953) Oct. 7.

When allowance is made for the instability of the excited states of H, it is necessary to replace the equation of Salpeter and Bethe (*Phys. Rev.* 84, 1232(1951)) by a set of coupled integral equations for representatives of the state vector. These representatives correspond to an electron-proton bound state and also to the electron and proton with any number of photons present. The coupled equations can be reduced to a single integral equation, which gives the

electron-proton bound state as an eigenstate of a modified propagator. The modified propagator is related to the two-body propagator of Salpeter and Bethe. The difference between the first approximation to the modified propagator and the first approximation to the two-body compound propagator can be represented by a displacement of its singularity in total energy-momentum space. This displacement gives in a relativistic form all the relevant contributions to the Lamb shift to this order; these include the contribution from low-energy transverse photons crossing over an arbitrary number of longitudinal photons; previously this term has always been deduced by physical arguments and obtained by nonrelativistic methods. The displacement of the singularity also gives decay coefficients to this order in the charge. The method can readily be extended to higher approximations. (auth)

URANIUM AND URANIUM COMPOUNDS

425

Los Alamos Scientific Lab.
NUCLEAR CHARGE DISTRIBUTION IN U^{235} 14 MEV NEUTRON FISSION. G. P. Ford. [1953?] Dec. Nov. 2, 1953. 4p. (AECD-3597)

Glendenin (NNS Div. IV, Vol. 9, paper 52) found that in the slow-neutron fission of U^{235} and Pu^{239} the fraction of fission fragments of a given mass A formed directly with a given charge Z is represented fairly well by a smooth function of $Z-Z_p$, where Z is the nuclear charge of the nuclide under consideration and Z_p is the most probable charge for the mass. It is shown here that the fraction of mass chains 82, 132, 134, and 136 from 14-Mev neutron fission of U^{235} can be represented roughly by a smooth curve parallel to the thermal curve. This seems to indicate that Z_p for U^{235} 14-Mev neutron fission has shifted toward stability, or that the neutron to proton ratio of the fission fragments is less for U^{235} 14-Mev neutron fission than for U^{235} thermal-neutron fission. (L.M.T.)